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Vol. XXII No. 2, 1997

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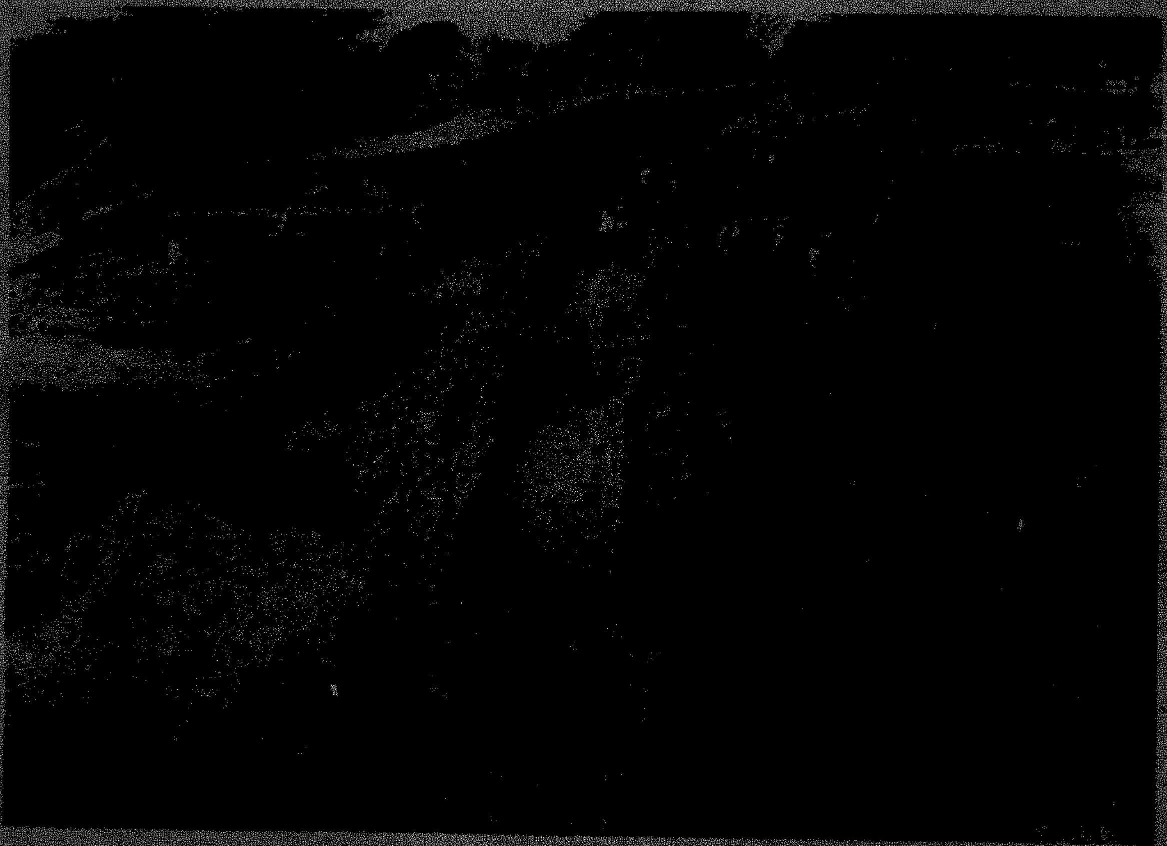

Indian Society for Prehistoric and Quaternary Studies

Man and Environment

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Man and Environment is published biannually in June and December. It publishes original research papers, review articles, excavation reports and book reviews. The scope of the Journal covers prehistoric societies and all aspects of their environment, as well as contemporary environment and simple societies with a relevance to the past.

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Publisher: Indian Society for Prehistoric and Quaternary Studies
c/o Department of Archaeology, Deccan College,
Pune 411 006, India.

Distributor: [illegible]
[illegible] Peth,
Pune 411 030.

Price: Rs. 400.00

Man
and
Environment

Journal of the
Indian Society for
Prehistoric and Quaternary Studies

Volume XXII, Number 2 (July–December 1997)

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Quaternary Stratigraphy and Morphology of Desert *Ranns* and Evaporite Pans in Central Rajasthan, India

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Abstract

The Quaternary stratigraphy of the three major types of *ranns* and gypcrete/calcrete pans in distinctive geomorphic settings and evolutionary stages along the margins of the Shergarh-Dechu dunefield in the central Rajasthan desert are disscussed here. The *ranns* at Thob (132-140 m AMSL), Jhalaria-Dediya and Lawan (226-234 m AMSL) owe their origin to neotectonic configurations of the bedrock. The Phalsund gypcrete and evaporite pans along the deranged course of the Lik Nadi — a relict misfit ephemeral stream — represent the arid environment post-dating the aeolian dynamism preserved as clustered parabolic megadunes. Based on the correlation of depositional records and event stratigraphy, a relative antiquity of these *ranns* and their palaeoclimatic implications are also discussed.

Introduction

Areas of internal (endoreic) drainage are important sedimentary environments and landscape components in many desert regions. In arid and semi-arid areas ephemeral and generally relict closed lacustrine features of varying scale and origin are called 'playas' or 'pans' (Shaw and Thomas 1989). These playas generally occur above the present groundwater table and they are subject to ephemeral surface water inundations of varying periodicity and spatial extent. Evidence for evaporite alternating with aeolian deposits and deflation features are commonly observed in these playas. Similarly *sabkha* is an Arabic term for a flat depression generally close to the water table, covered with salt crust and bordered by sand dunes (Fairbridge 1968: 967). These depressions are generally not fed by streams or surface run-off. On the contrary, groundwater fluctuations and subterranean flow influence their evolution in terms of morphology, hydrology and sedimentology. *Rann* or *sar* are the Indian terms equivalent to playa and pans e.g. Thob *Rann*, Pokaran *Rann*, Bap *Rann*; Lunkaransar, Jamsar, etc. The larger sized inland basins in the desert region that are fed by the seasonal surface water flows are placed in the category of the saline desert lakes, such as Sambhar, Didwana and Kuchaman.

Ranns or enclosed desert drainage basins with internal drainage are important inland (*sabkha*) arid sedimentary environments in Rajasthan. They are largely flat, vegetation-free surfaces of fine-grained sediments. Although halophytic flora such as shallow rooted grasses and other succulents may thrive seasonally, episodic flooding and salt accumulation do not favour the establishment of permanent vegetation in the *ranns*. Playas and desert lakes or the drainage terminal sinks generally owe their origin and development to one of the following:

1) structural parameters — faulting and rifting,
2) erosional effects of deflation and subsurface solution/ karstic activity,
3) ponding of ephemeral or abandoned drainage lines, floodplain depressions, interdune flats/swales (e.g. Shaw and Thomas 1989; Cooke *et al.* 1992).

Inland basins fed by ephemeral centripetal drainage in hot semi-arid/arid regions host a variety of evaporite minerals. The type and nature of such evaporites depend primarily on the composition of water-sediment influx and on subsequent modifications in water geochemistry owing to evaporation and precipitation of the less soluble carbonate and sulphate constituents (Bowler 1986). There is overwhelming evidence for alternating expansion and contraction of lakes during the Late Quaternary period in low latitude regions affected by past arid climates (Yan and Petit-Maire 1994). Contraction of formerly more extensive lakes is indicated by exposed lacustrine sediments or by geomorphic features such as abandoned lake shorelines, cliffs or scarps and overflow channels (Catt 1988). Generally, migratory sand dunes cover the dessicated lake basins due to increased aridity (Grove and Warren 1968). Changes in lake size reflect past variations in rainfall associated with the shifting of climate zones in response to the expansion and contraction of polar ice caps. Globally, wet periods/ pluvials and dry periods/interpluvials have been correlated with the glacials and interglacials of the higher latitudes. However, recent dating has proved that pluvials in some regions, for instance in east Africa, coincide with the warmer intervals of the mid-latitudes (Goudie and Pye 1983; Street and Grove 1976).

Important geomorphological and geochemical investigations in desert *ranns* and evaporite pans in the Thar desert in India have been carried out by Ghose (1964); Ghose *et al.* (1977); Khandelwal (1975); Paliwal (1982); Wasson *et al.* (1983, 1984); Kar (1990, 1992); Rai (1990, 1992); Deshmukh and Rai (1991); Dhir *et al.* (1992, 1994); Achyuthan and Reddi (1993); Sundaram and Rakshit (1994); Sundaram and Pareek (1995) and Wadhawan (1996). Notable contributions to Late Quaternary palaeoclimate based on palynological studies of some major desert lake basins in Rajasthan are Singh *et al.* (1972, 1974, 1990); Vishnu-Mittre (1977, 1982) and Deotare and Kajale (1996).

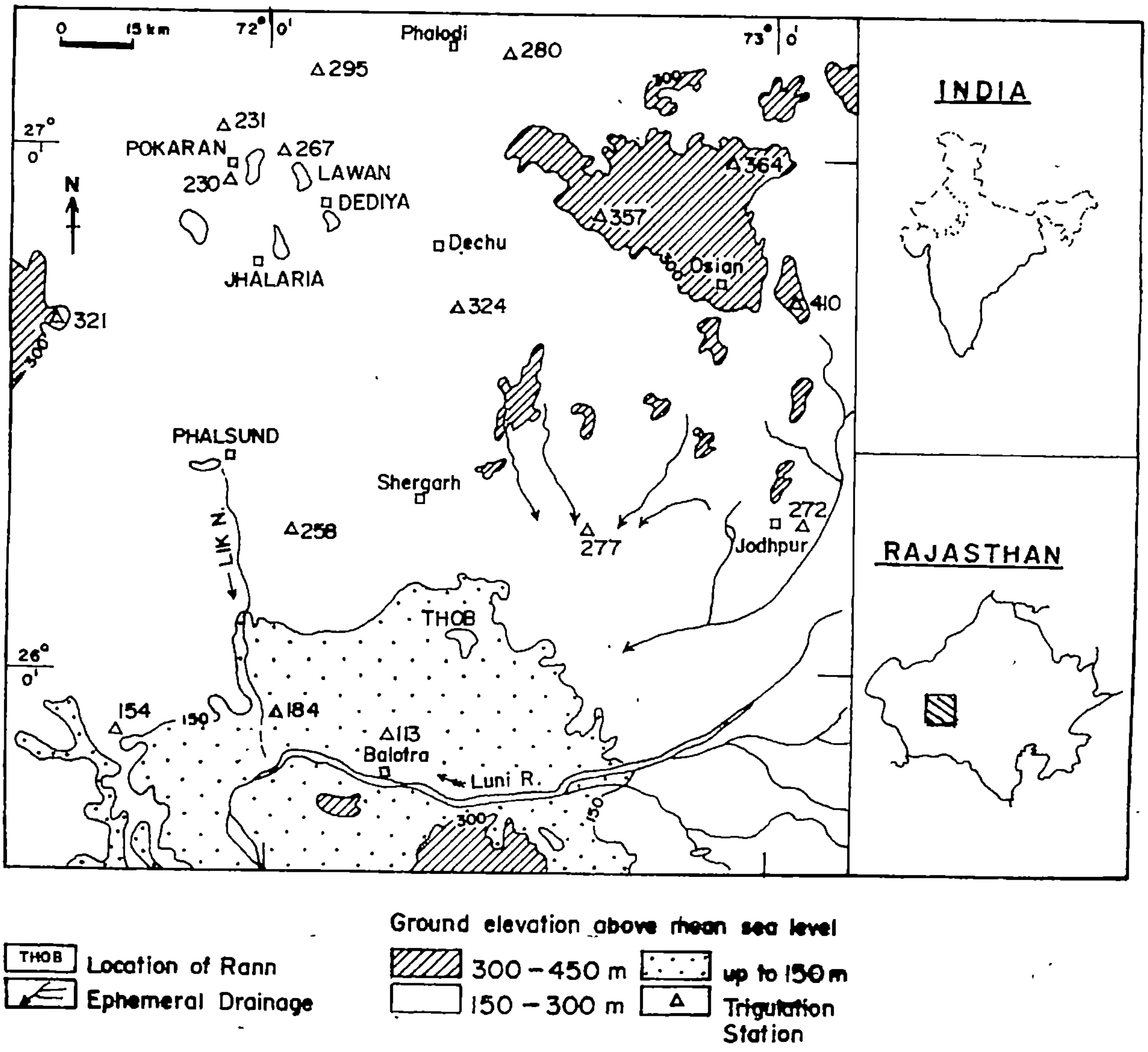

Fig. 1: Central Rajasthan desert: location map of *ranns* and evaporite pans

Study Area

The Quaternary stratigraphy and morphology of the three major types of *ranns* and gypcrete pans in the central Rajasthan desert are enumerated below and show distinctive geomorphic-geologic setting (Fig. 1) and are in different stages of their evolution:

1. Thob Rann is a shallow intermontane lacustrine depression within the rhyolite hills on the southeastern desert margin.
2. Phalsund gypcrete occurs as playa evaporite pans along the deranged course of a relict misfit ephemeral stream — the Lik Nadi; engulfed intermittently by aeolian deposits.
3. A series of *ranns* at Jhalaria-Dediya and Lawan occur as small northerly elongated depressions in the rocky hamada and low dissected plateau over sandstones of the Jodhpur Group, on the northwestern margin of the parabolic dunefield in the central Rajasthan desert.

Thob Rann

Thob Rann is situated on the southeastern fringe of the Shergarh-Dechu Quaternary continental sedimentation sub-basin and stabilised parabolic dunefield. It is bound on the east and northeast by rocky uplands — a discontinuous NE-SW extending tract of residual hills of the Malani Igneous Suite (the Thob-Trisingri-Mohanpura-Mandli-Agolai-Undrio tract). Thob Rann forms a nearly horizontal infilled basin covering an area of about 11 sq km with a mean ground elevation of 132 m AMSL. It is a bilobed playa with a maximum east-west extent of 10 km and a north-south stretch of 7 km. Northwesterly trending dissected residual hills of purple-maroon rhyolite and welded tuff and accompanying colluvium covered pediments constitute the southwestern margins. These hills attain maximum heights of 261 m AMSL, thus providing a basin relief ratio of 130 m to the *rann* level. However, a bank-top overflow outlet at about 140 m elevation on the southern margin is inferred as a morphotectonic barrier enclosing thereby an intermontane basin. The western and northern boundaries of the *rann* are formed by stable and superimposed clustered parabolic dunes with relief ranging from 11 to 30 m (Fig. 2).

The Thob Rann remains dry for most of the year, but receives seasonal surface run-off through centripetal and sub-parallel drainage from the surrounding uplands. Three pit sections were made and geological stratalogs prepared

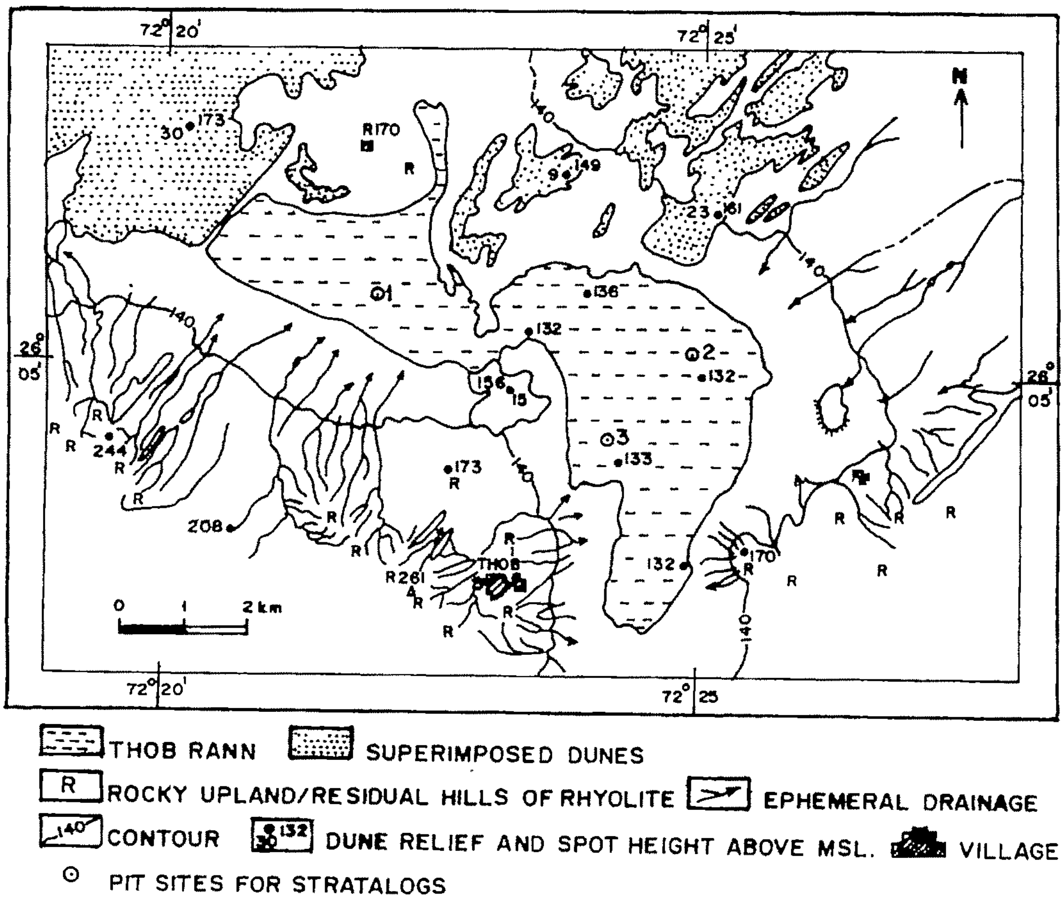

Fig. 2: Geomorphic setting of Thob Rann

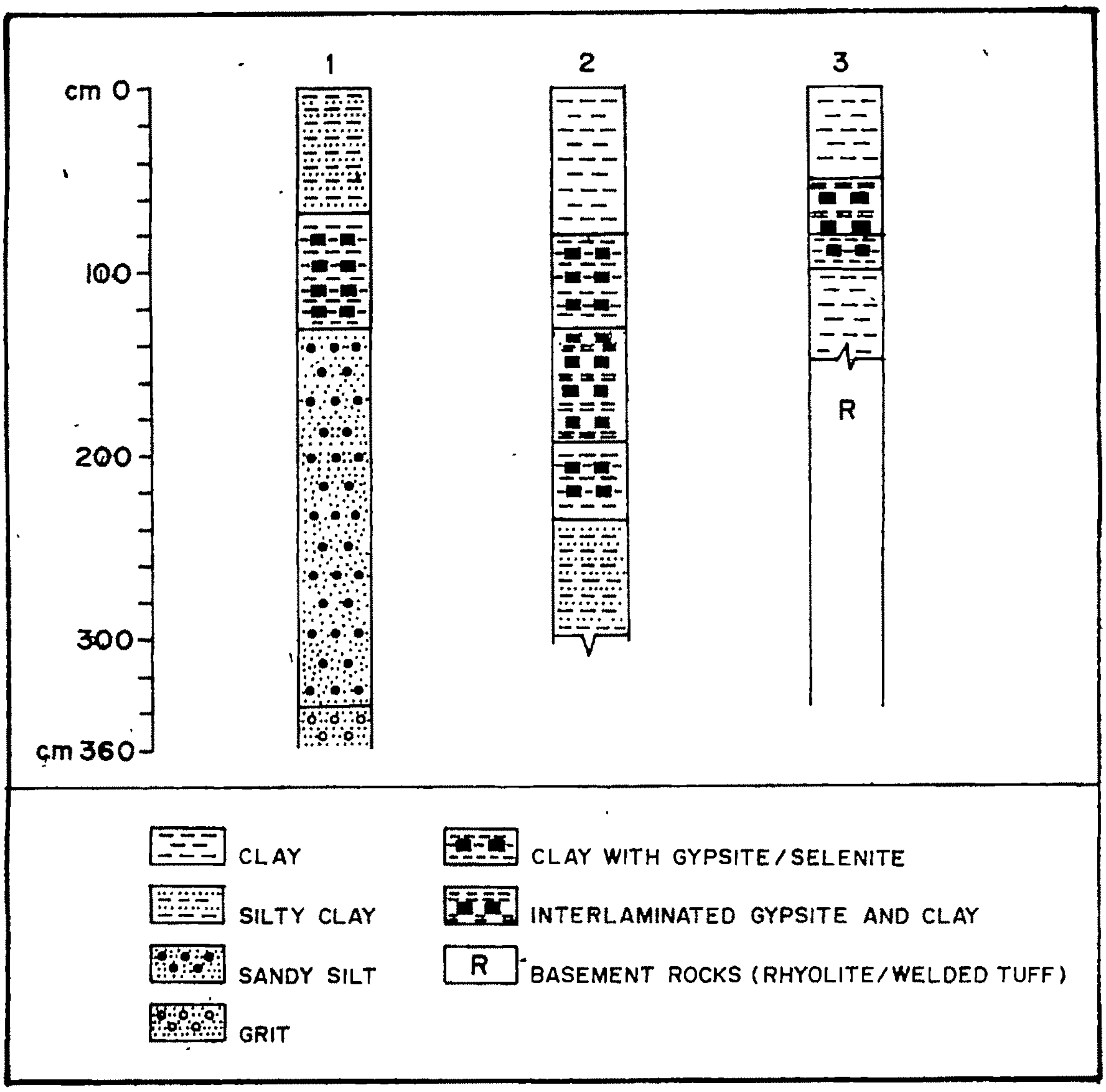
1
2
3
cm 0
100
200
300
cm 360
R
CLAY
SILTY CLAY
SANDY SILT
GRIT
CLAY WITH GYPSITE/SELENITE
INTERLAMINATED GYPSITE AND CLAY
BASEMENT ROCKS (RHYOLITE/WELDED TUFF)

Fig. 3: Geological strata-logs of the Thob Rann

(Fig. 3). Presently infilling fine-grained silty-clay/clayey loam sediments and dissolved salts constitute the top parts of the litho-succession. This is sharply separated by intercalated gypsite-clayey loam and coarse crystalline gypsum (selenite) — clay ensemble at a depth of 1 to 3 m below ground level. A pebble conglomerate and grits comprising ill-sorted, subrounded to subangular clasts of vein-quartz, sandstone, rhyolite and lithomargic clay-balls occur at the base of the Thob Rann, implying a channel bed deposition. The formation of selenite suggests extreme aridity, while the alternate laminations of clay and gypsite which follow suggest a fluctuating environment. Owing to the fine grained surface deposits of saline clayey silt, polygonal shrinkage cracks are commonly developed. Other surface features include salt encrusted soft, friable puffy efflorescences.

Aerial photo-interpretation of the area indicates the presence of intersecting lineaments trending NNW-SSE and NE-SW (Fig. 4). Disposition of inferred tectonic lineaments and field survey data on differential thickness of Quaternary valley-fills in contiguous blocks in the Shergarh-Dechu sub-basin suggest that the Thob Rann ominously occupies a tectonic trough or part of a sagged (pulled apart) segment of a southerly flowing palaeo-channel. Blocked channel conditions, due to neotectonic activity are seen in the lithostratigraphic record (Fig. 3), shown by a well developed Quaternary fluvial aggradational episode which terminates abruptly and is overlain by interlaminated gypsite (Wadhawan 1996; Wadhawan and Sural 1991).

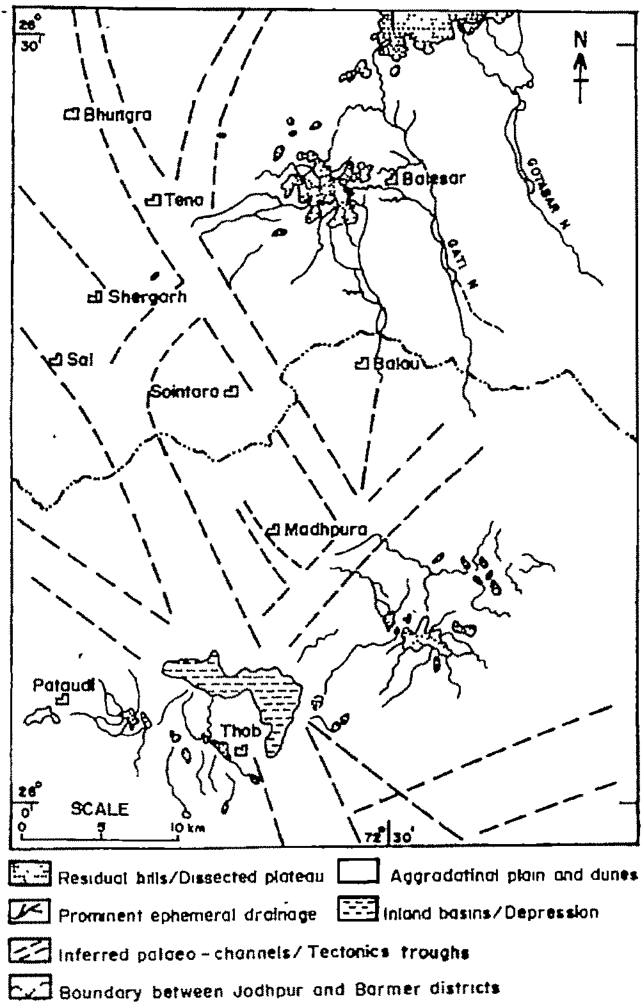
N
26°
30'
Bhungra
Teno
Balesar
Shergarh
Sal
Sointara
Balau
Gotasar N
Gati N
Madhpura
Pataudi
Thob
26°
0'
SCALE
0
5
10 km
72°30'
Residual hills/Dissected plateau
Aggradational plain and dunes
Prominent ephemeral drainage
Inland basins/Depression
Inferred palaeo-channels/Tectonics troughs
Boundary between Jodhpur and Barmer districts

Fig. 4: Intermontane tectonic setting of the Thob Rann showing disposition of inferred palaeo-channel/tectonic troughs in the Shergarh-Dechu sub-basin

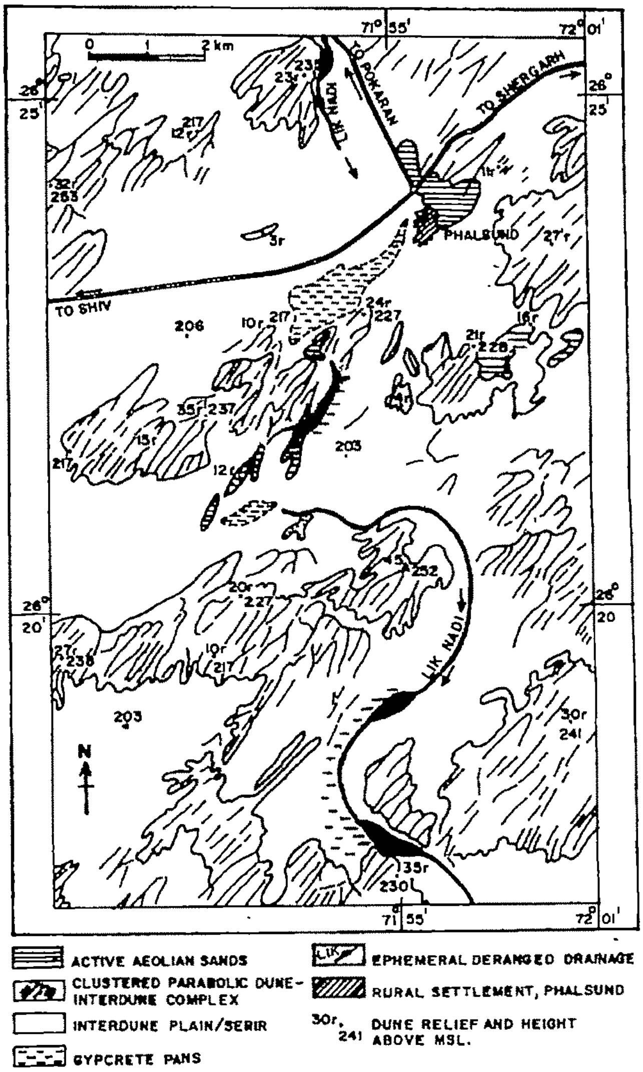

Fig. 5: Geomorphic setting of the Phalsund gypcrete pans and deranged Lik Nadi in the dune-invaded terrain

Phalsund Gypcrete Pans

Gypcrete pans occur as discrete near surface evaporite deposits to the southwest of Phalsund village. These evaporite pans have developed as buff-white crusts of massive amorphous gypsum confined within the older flood plain of the presently deranged Lik Nadi (Fig. 5). They broadly define the western margin of the Shergarh-Dechu parabolic dunefield, occupying areas to the north of the river Luni. The general ground elevation of the gypcrete pan and adjacent interdune plain is around 203 m AMSL. The stable dune relief in the terrain varies from 10 to 45 m.

The Phalsund gypcrete is observed to overlie yellowish green and pale brown well sorted calcareous sands at the eastern end whereas intercalated grey silty loam and medium grained quartzose sands underlie the gypcretes at the western end. The latter in turn are underlain by calcretised pebbly conglomerates. Relevant strata-logs are given in Figure 6.

The gypcrete pans presently occupy vast interdunes and occur overlying consolidated aeolian and reworked aeolian sands in the area. Large polygonal desiccation cracks are developed over the gypcrete crust. These cracks also show subsequent infilling by calcareous clays. Morphostratigraphic and sedimentologic evidence suggest that increased aridity and enhanced encroachment of clustered parabolic dunes resulted in the obliteration of the once regular through flowing and well integrated course of the Lik Nadi creating thereby pools and depocentres of evaporative concentrates.

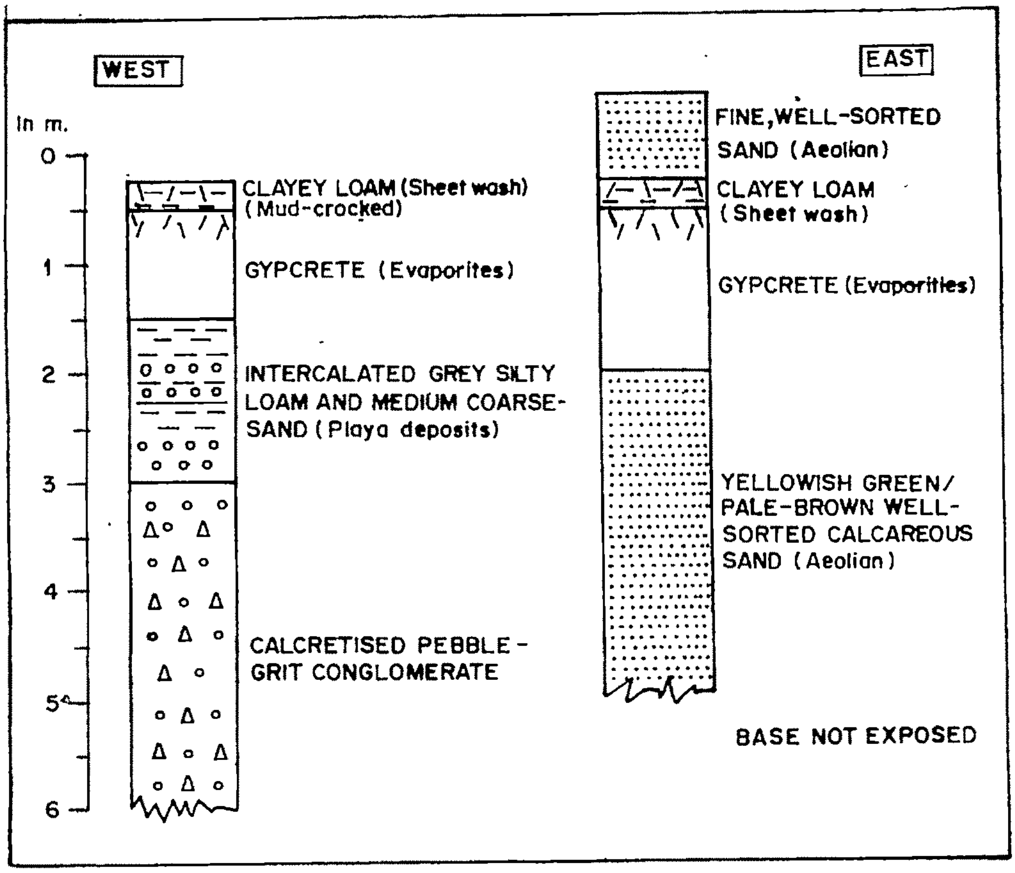
WEST
EAST
In m.
0
1
2
3
4
5
6
CLAYEY LOAM (Sheet wash) (Mud-cracked)
GYPCRETE (Evaporites)
INTERCALATED GREY SILTY LOAM AND MEDIUM COARSE-SAND (Playa deposits)
CALCRETISED PEBBLE-GRIT CONGLOMERATE
FINE, WELL-SORTED SAND (Aeolian)
CLAYEY LOAM (Sheet wash)
GYPCRETE (Evaporites)
YELLOWISH GREEN/ PALE-BROWN WELL-SORTED CALCAREOUS SAND (Aeolian)
BASE NOT EXPOSED

Fig. 6: Geological strata-logs of the Phalsund gypcrete pans representing the inland *sabkha* environment

Jhalaria-Dediya-Lawan *Ranns*

A chain of small *ranns* or enclosed inland clayey pans occur along the northwestern margin of the stable parabolic dunefields (Fig. 7 and 8). These *ranns* occupy depressions in the undulating rocky plains or hamada over ferruginous sandstones of the Jodhpur Group and gravel/pebble strewn gibber flat (serir). The ground elevation of these vegetation free flat surfaces of fine sediments along the northwestern peripheries of the dunefields is 227 m at Jhalaria *Rann*, 226 m at Lawan *Rann* and 234 m at Dediya *Rann*.

Jhalaria Rann measures 5.5 x 2.0 km and occupies a N-S elongated depression that receives ephemeral run-off from EW oriented subparallel channels from the hamada/rocky plains situated 240 AMSL. The peaks of these dissected plateaux reach 251 m on the west but higher levels of 271 m on the east (Lalpura). An integrated 3rd order channel drains into the Jhalaria Rann from the eastern rocky upland. A stabilised clustered parabolic dunefield abuts against the rocky ledges on the eastern margin of the *rann*. A limonite-coated rhyolite and sandstone gravel/pebble conglomerate and grits (max. 1 m thick) with crimson red calcareous sandy silt matrix is encountered in the *rann*. These clastics are calcretised in their upper parts by white nodular and powdery calcretes. The basement rocks of fissile red-purple shale belonging to the Jodhpur Group underlie the cemented gravel-clays of the Quaternary. Recent mobile aeolian sands are seen occupying the eastern and southwestern edges of the *rann*. Shrub coppices and long tapering obstacle-lee linear sandy mounds are common bedforms owing to the prevalence of stronger sand moving winds in the vicinity. It is noteworthy that the entire Quaternary litho-succession encountered here represents a fluvial deposition only and the lacustrine phase is recorded in the Subrecent *rann* deposits. However, the geomorphic evidence suggests that the Jhalaria *Rann* could have had palaeo-channel links with other *ranns* in the vicinity especially the Pokaran *Rann* occurring about 15 km to the north and showing a well developed succession of similar deposits with a pronounced evaporite phase (Rai 1990).

Dediya Rann is oval shaped and occupies a northwesterly elongated depression within the dissected sandstone hamada highs exposed on the northeast and south-

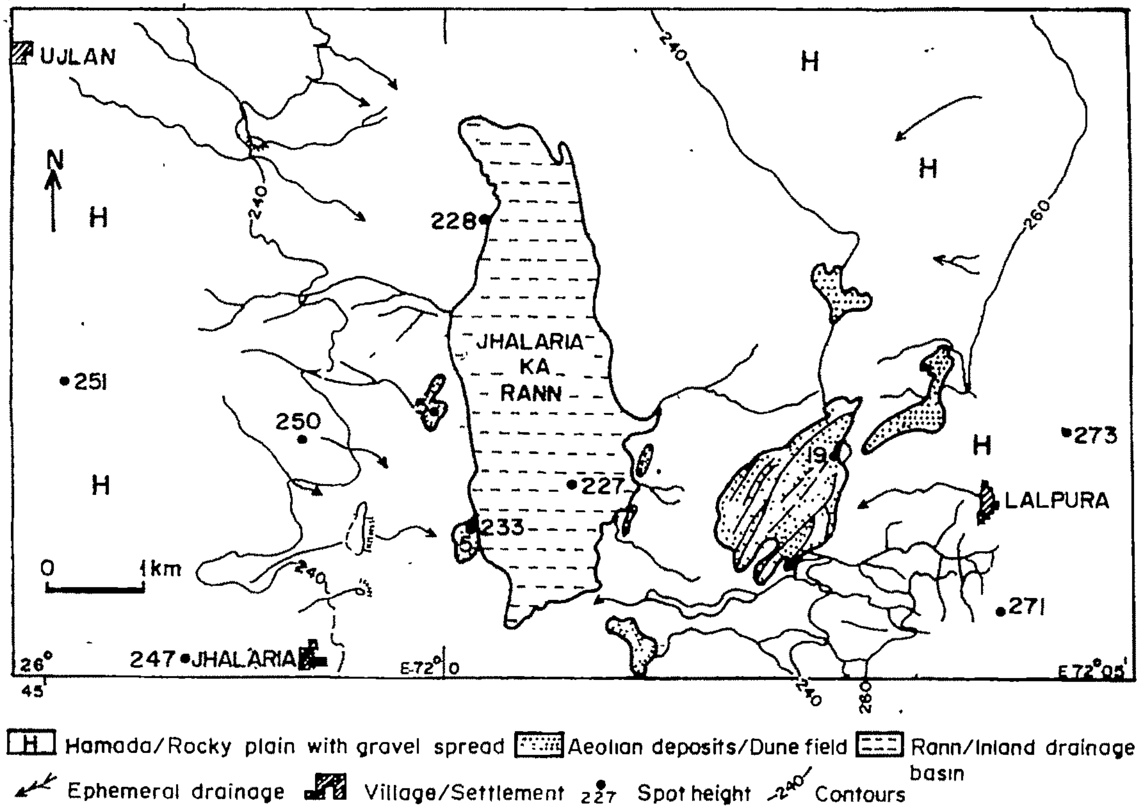

Fig. 7: Geomorphic setting of the Jhalaria *Rann*

west. NE-SW oriented sub-parallel channels intermittently drain the hamada highs. The flat surface of the *rann* measures 3.5 x 2.5 km and is 234 m AMSL whereas the hamada rocky plain occurs at 260 m. It is remarkable that the intensity of dissection is higher on the northeastern upland in marked contrast to lesser dissection density on the southwest of the Dediya Rann (Fig. 8). Stable and active aeolian deposits occur to the southeast of the *rann*. Dediya Rann shows a well developed lacustrine phase. The lower most lithounit seen in the pit section is that of intercalated layers of olive green clays comprising illite and kaolinite with abundant quartz and feldspars and fine grained pale white gypsum, indicating fluctuating groundwater conditions during its formation (Wadhawan and Sural 1991).

The middle level unit consists of mottled green-orange clays lacustrine mud with bioturbation features owing to subaquous organic activity. Halite, calcite, kaolinite and illite are present apart from abundant quartz and feldspar. Tiny prismatic crystals of gypsum are disseminated in this unit. The uppermost unit is represented by reddish brown silty clays with minor amounts of gypsum, kaolinite, illite and feldspar minerals. Haematite is identified as the red colouring pigment in these fine clastic sediments indicating the prevalent aridity affected oxidising environment. The entire succession is about 2 m thick.

Lawan Rann occurs as a northwesterly continuation of the Dediya Rann in a similar structural disposition. A tectonic hump of the Marwar Group of rocks at about 240 m level separates the two inland *sabkha* basins (Fig. 8). Lawan Rann is 5 x 2.5 km in extent and the flat lies at 226 m AMSL. The northeastern rocky hamada surface over ferruginous sandstone is at 260 m whereas the south-western and western dissected rocky uplands and pediments are occupied by the purple rhyolite belonging to the Malani Igneous Suite and occur at the relatively lower level of 240 m AMSL.

The maximum thickness of Quaternary sediments in the central parts of Lawan Rann is about 1.5 m. The basal parts comprise thinly bedded grits as unevenly distributed lag-deposits laid by braided channels. The middle unit is lacustrine mud, grey-green clays and silty clays with tiny prismatic and bladed gypsum crystal. Laminated dark brown muds with disseminated gypsum specks comprise the uppermost lacustrine unit.

The *en echelon* disposition of these *ranns*, their aligned and similarly elongated basin configuration, sub-parallel ephemeral drainage network and differential relative relief — mostly higher on the eastern/northeastern parts of the *ranns* support the contention that these *ranns* owe their genesis to structural warps and tectonic charac-

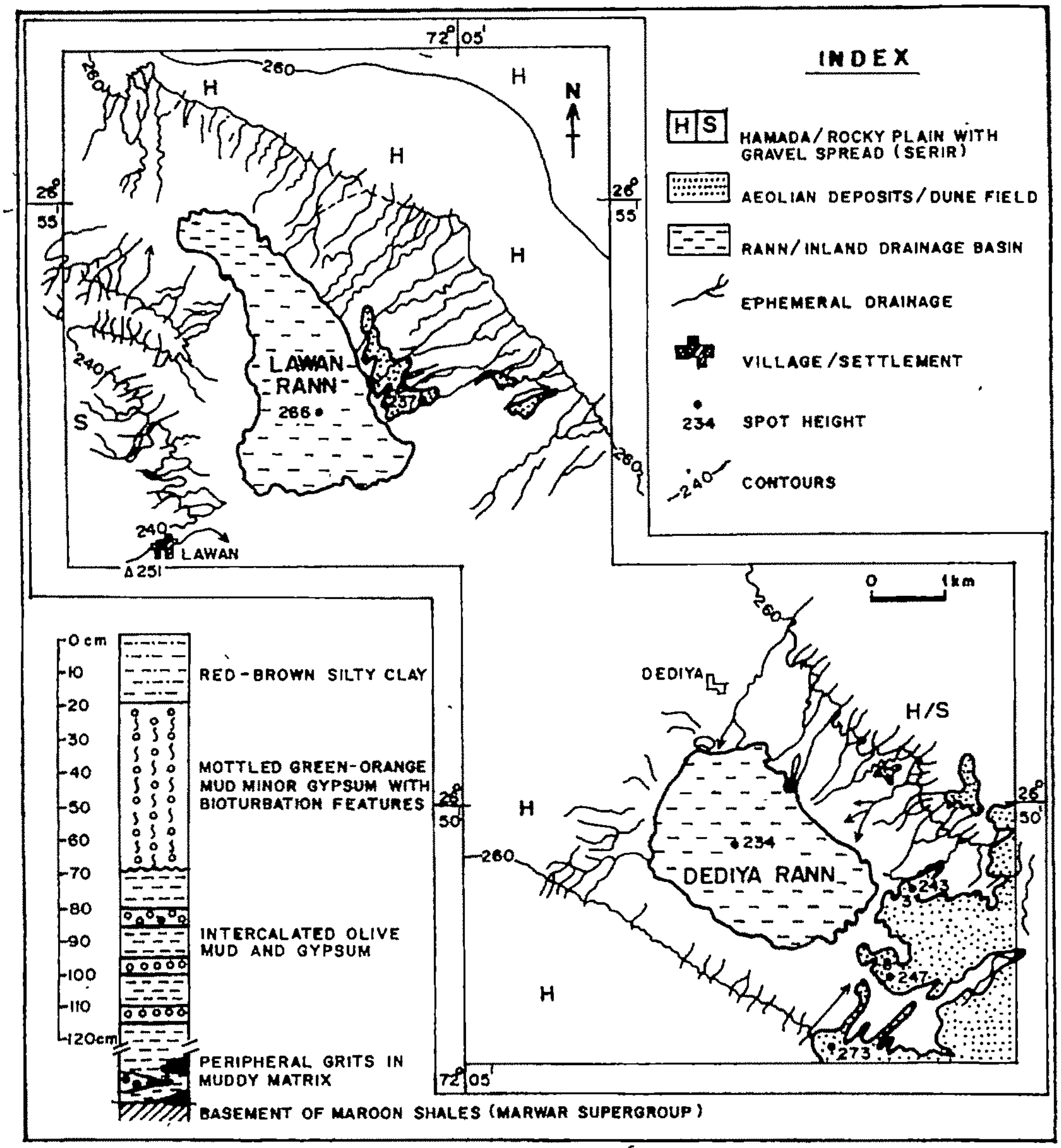
INDEX
H S
HAMADA/ROCKY PLAIN WITH GRAVEL SPREAD (SERIR)
AEOLIAN DEPOSITS/DUNE FIELD
RANN/INLAND DRAINAGE BASIN
EPHEMERAL DRAINAGE
VILLAGE/SETTLEMENT
234 SPOT HEIGHT
240 CONTOURS
72°05'
28°55'
260
240
N
H
S
LAWAN RANN
266
237
LAWAN
Δ251
0 1km
DEDIYA
H/S
DEDIYA RANN
234
243
247
273
28°50'
0 cm
10
20
30
40
50
60
70
80
90
100
110
120cm
RED-BROWN SILTY CLAY
MOTTLED GREEN-ORANGE MUD MINOR GYPSUM WITH BIOTURBATION FEATURES
INTERCALATED OLIVE MUD AND GYPSUM
PERIPHERAL GRITS IN MUDDY MATRIX
BASEMENT OF MAROON SHALES (MARWAR SUPERGROUP)

Fig. 8: Geomorphic setting and geological strata-logs of the *ranns* at Dediya and Lawan

teristics (push-up swell and pull-apart basin sequence) of the underlying bedrock. The shallowness and lithologic immaturity of the Quaternary deposits in these neotectonically controlled depressions suggest a Subrecent age.

Palaeoclimatic Implications

Although these pans and playas occupy a relatively small area of the arid landscape, they represent a significant component of the desert sedimentary environment. These *ranns* represent a crucial interface between surface water and groundwater processes operative in a variety of morphotectonic settings. The present study which includes the surface morphology and litho-stratigraphic succession of playas has indicated their evolutionary stages and brought out their palaeo-climatic significance.

The Thob Rann and the *ranns* of Jhalaria-Dediya and Lawan owe their origin to the structural architecture of the bedrock. Thob Rann is an intermontane basin within the residual hills of the Malani Igneous Suite whereas the *ranns* of Jhalaria-Dediya-Lawan occur in shallow structural depressions in the rocky sandstone plains of the Jodhpur Group. Presently they constitute surface discharging playas distinguished by a periodic influx of fine-grained sediments and evaporite formation.

The Phalsund gypcrete on the other hand represents a palaeo-playa occurring in the flood plain of the presently deranged ephemeral Lik Nadi. It is surrounded by stabilised aeolian deposits. The clustered parabolic megadunes that occur astride, should have obstructed the prior channel courses. The onset of associated aridity led to evaporite formation in the segmented pools.

Collation of the sequence stratigraphy of these *ranns* reveal, that the Thob *rann* witnessed a widespread wetter climatic episode (preserved as the basal Quaternary conglomerates) when the palaeo-channel courses were through flowing as tributaries of the river Luni in the south (Fig. 1 and 4). The blocking of passages due mostly to the inferred neotectonic movements and the oldest dune building activities marked the beginning of lacustrine accumulation facies. The occurrence of laminated/intercalated gypsum formation indicates intense aridity with short-lived seasonal wet interludes (perhaps coeval with the period of colluvio-aeolian episodes recorded in the Shergarh Trijunction (Dhir *et al.* 1992). Major clustered parabolic megadunes also developed in the continuing arid conditions especially in the lowlands — elongated alluvial basin/valley fills bordering the Thob Rann on its west. The gravelly bed load of the Lik Nadi appears to have been calcretised during this dry phase. Intermittent pulses of flash flood discharges must have brought concentrates of dissolved salts. Such ephemeral flooding of interdunes and depressions in older floodplains of the Lik Nadi provided (and have been supplying albeit intermittently) suitable material and locales for the formation of evaporitive gypcretes, e. g., near Phalsund and further downstream (Fig. 5).

The semi-arid wet interlude that followed parabolic megadune formation seems to have provided sediment influx to the *ranns* of Jhalaria-Dediya and Lawan which were linked mutually by a shallow palaeo-channel. The subsequent intensification of aridity (c. 4-6 Ka B.P., Chawla *et al.* 1992) that led to the formation of meso-scale transverse and longitudinal dunes in the area favoured the formation of gypsum laminations in the *ranns* of Dediya and Lawan. Thus these *ranns* appear to be either coeval or relatively younger than the Phalsund gypcrete pans. Intensified aeolian dynamism as represented by clustered parabolic megadunes apparently separates the older evaporite phase preserved at the Thob Rann from the younger one formed at Phalsund and other deranged sectors of the Lik Nadi in the central Rajasthan desert.

Acknowledgements

S.K. Wadhawan thanks the Deputy Director General, Geological Survey of India, Western Region for providing opportunities and facilities to work in the Thar desert.

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Microlithic Sites in the Tarafeni Valley, Midnapur District, West Bengal: a Discussion

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Abstract

This is a systematic study of the prehistory of Tarafeni valley. Detailed analysis of the distribution and context of the sites has been made. A new methodology has been adopted for stone tool analysis in which the entire reduction procedure is studied. Overall, the emphasis has been on the presentation of an integrated picture of human behaviour.

Introduction

The author has attempted a holistic study of the prehistory of the Tarafeni valley, Midnapur District where, so far, only sporadic surveys have been made with little information on the stratigraphy of individual sites and on the typological classification of artefacts.

Prehistoric research in West Bengal has been largely confined to the southeastern fringe of the Chota Nagpur plateau in the western part of the state covering an area of about 3000 sq km — an area covering the whole of Purulia District and the western parts of the districts of Bankura, Burdwan, Birbhum and Midnapur districts. Explorations by earlier workers (IAR 1959-60; Sen *et al.* 1963; Ghosh 1961, 1962, 1966; Ghosh and Das 1966; Chakrabarti and Chattopadhyay 1984a, 1984b; Datta *et al.* 1984; Datta 1991a and b, 1995; Chakrabarti 1993) revealed the potential of the region. However, certain limitations are present in these studies which typify the culture-history approach in vogue in Indian archaeology in the 1960s (Paddayya 1978). In a few cases where primary sites were taken up for investigation (Lal 1958; Chakrabarti *et al.* 1982; Datta *et al.* 1984) they represented isolated units of analysis. Datta *et al.* (1984) documented the presence of a number of microlithic and Upper Palaeolithic sites in the catchment area of the Tarafeni valley which they felt was a natural habitat for human occupation. Chakrabarti and Chattopadhyay (1984b) reported sites from the rest of the valley. Only a brief cataloguing of sites and a sketch of their typological repertoire was presented in these works. Trenches were taken at two sites for stratigraphic details, but their implications for the entire region were not specified (Datta *et al.* 1984; Datta and Ray 1989). Thus, what was found to be lacking in research into Bengal's prehistory was a holistic and systematic study of the archaeological record of a region or natural unit. So it was felt necessary to select such an area for detailed analysis. The Tarafeni valley was selected because it coincides with a natural division, and explorations by earlier workers showed its potential for archaeological work.

Detailed investigations were carried out in the course of four field seasons. Twentyfour sites were known from the region based on discoveries reported by previous workers (Table 1), and an additional 25 sites were discovered in the course of the work reported here. A total of 49 sites are therefore known from the Tarafeni valley.

The survey of microlithic sites was begun with the assumption that human activity is spatially continuous and is reflected in the distribution of the archaeological record across the landscape. Sites were defined as discrete clusters of artefacts occupying nodal points in the landscape as distinguished from occurrences of isolated artefact(s) or diffuse scatters continuing between the sites and distributed throughout the region. The importance of these scatters termed as 'off-site' or 'non-site' has been highlighted in

Table 1: Sitewise distribution of raw material blocks, flakes and cortical flakes

Site	**Raw Material Blocks**	**Flakes**	**Cortical Flakes**
Kurabhashapal	2	191	53
Baishnabpur 1	0	174	28
Baishnabpur 2	3	229	45
Ghagra	0	45	14
Kalapathar	0	22	2
Balidanga	0	33	13
Dhuliapur	0	74	33
Enthela	1	189	19
Jallangdih	1	50	8
Bamundiha 1	0	44	1
Pukhuria	0	0	0
Bamundiha 2	0	14	5
Rajdoha	0	2	0
Gopalpur	0	3	1
Kantharpal	0	5	4
Kaliam	0	6	2
Mohanpur	0	7	1
Kattara	4	111	21
Aguibil 2	3	140	25
Benghuta	1	30	8
Barighati 1	1	22	6
Barighati 3	0	38	17
Majigara	0	39	15
Ashri 1	2	44	5
Srinathpur	0	26	6
Gidighati	0	21	5
Aguibil 1	0	4	4
Gohalberia 1	1	14	7
Gohalberia 2	0	10	5
Patpinra	0	4	0
Barighati 2	1	8	5
Barighati 2 extension	0	5	2
Akuldoba	3	5	2
Dongardihi	0	6	4
Dumohani	0	11	8
Pataghar	1	8	4
Barapal	0	8	4
Kandarbhula 1	0	5	4
Kandarbhula 2	0	4	0
Susnijobi	0	6	5
Kasijora	0	8	5
Ashri 2	1	6	1
Adargaria 1	0	6	3
Adargaria 2	0	2	0
Joram	0	4	1
Amadubi	0	1	0
Madhupur	0	6	3
Charakpahari 1	0	4	0
Charakpahari 2	0	2	1
Total	25	1696	405

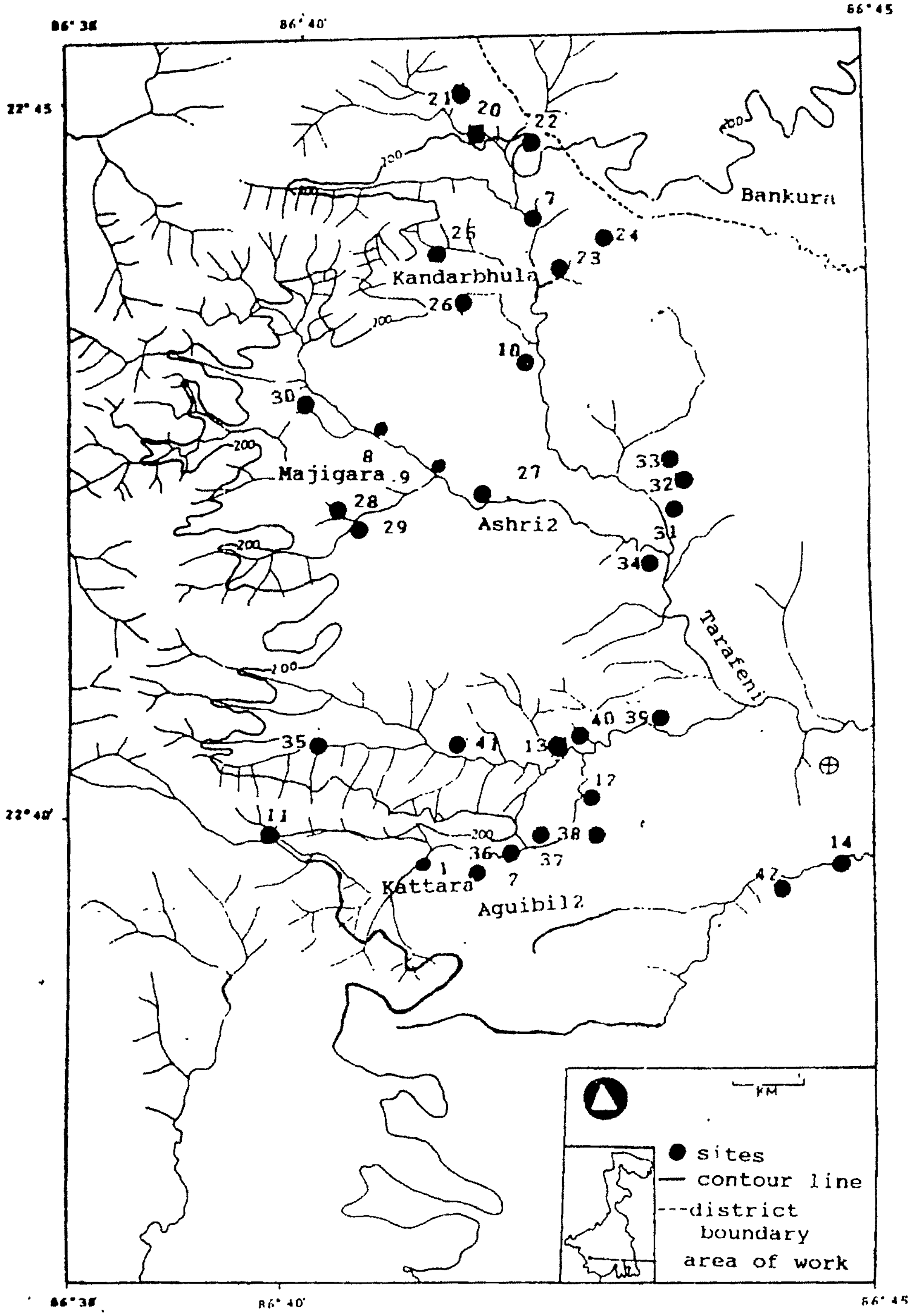

Fig. 1: Map of the upland region, Tarafeni Valley, showing distribution of sites

List of microlithic sites in the region (Fig. 1-2)

Sr. No.	**Newly Discovered By Author**	**Sr. No.**	**Previously Reported**	**Reference**
02	Aguibil 2	01	Kattara	a
04	Baishnabpur 2	19	Dhuliapur	a
05	Kurabhashapal	07	Srinathpur	b
12	Barighati 1	09	Ashri 1	b
13	Barighati 3	20	Dumohani	b
14	Kalapathar	21	Pataghar	b
16	Jallangdih	22	Barapal	b
27	Ashri 2	10	Gidighati	b
28	Adargaria 1	24	Susnijobi	c
29	Adargaria 2	08	Majigara	c
32	Charakpahari 1	25	Kandarbhula 1	c
33	Charakpahari 2	26	Kandarbhula 2	c
35	Dongardihi	30	Joram	c
36	Aguibil 1	31	Madhupur	c
37	Gohalberia 1	34	Amadubi	c
38	Gohalberia 2	17	Bamundiha 1	d
39	Barighati 2	18	Balidanga	d
40	Barighati 2	23	Kasijora	e
41	Akuldoba	49	Mohanpur**	e
42	Patpinra	06	Enthela	f
43	Pukhuria	46	Kantharpal (Hijla)	f
44	Bamundiha 3	03	Baishnabpur*	g
45	Gopalpur	15	Ghagra	g
47	Rajdoha	11	Benghuta	h
48	Kaliam			

*: only Palaeolithic implements mentioned in the report
**: Only one scatter in the region is associated with lateritic deposits. It is not known whether it is contemporary with the other sites/scatters.
a: De and Samanta (*IAR* 1983-84: 93, 94).
b: De *et al.* (*IAR* 1982-83: 104).
c: Datta *et al.*(1984: 23).
d: Ghosh and Sen (*IAR* 1964-65: 48).
e: Chakrabarti and Chattopadhyay (1984a: 41).
f: Chakrabarti and Chattopadhyay (1984b: 45).
g: Ghosh (1966: 87).
h: Samanta (1993-94).

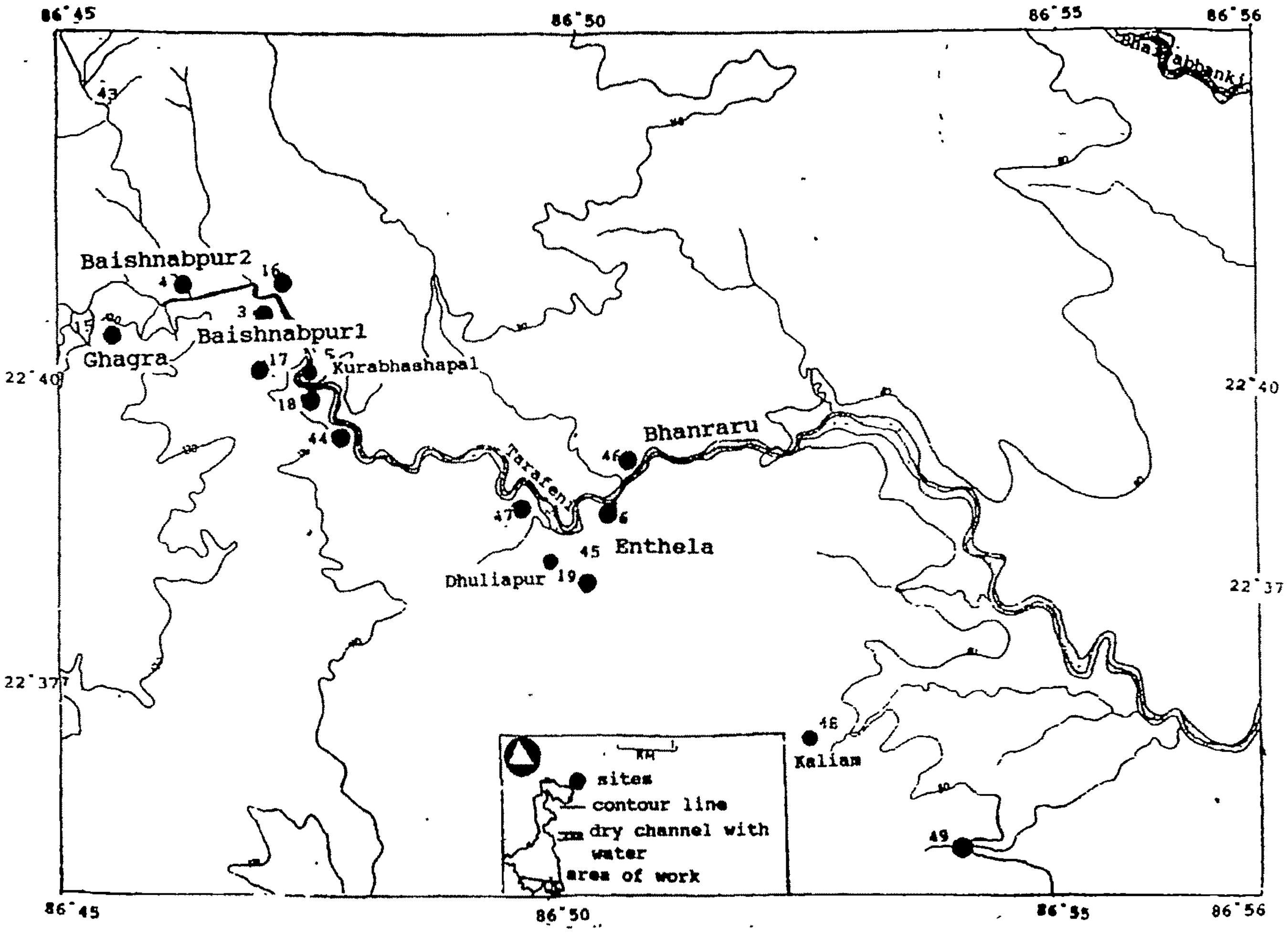

Fig. 2 Map of the low lying region, Tarafeni valley, showing distribution of sites

recent years (Thomas 1975; Foley 1981; Issac *et al.* 1981; Dunnel and Dancey 1983; Ebert 1986). Thus information was gathered about the location of both 'sites' and 'off-sites' with respect to the natural features. A multidisciplinary approach involving geology and palaeontology was adopted to study their context. Next, the entire assemblage and not only the 'finished tools' were taken as the unit of analysis to look at the fundamental steps of the blade reduction technique. The aim was to look at the processes of raw material procurement, manufacture, use, maintenance and discard of tools as they are reflected in the assemblage as a whole. These would reflect, it was felt, the past strategies and plans of land use adopted to cope with the environment in a particular context. These ideas are based on what is known as the study of "organization of technology" (Binford 1973, 1977, 1979; Ebert 1979, 1986; Kelly 1983, 1988; Torrence 1983, 1989; Bamforth 1986; Bleed 1986; Gamble 1986; Shott 1986) and is different from the study of a set of objects or "tools", an industry or a particular production technique which are the products of this adaptation (Nelson 1991). Ethnographic and ethnoarchaeological case studies on hunter-gatherers in different environments have been used as a device to gain an insight into past strategies of land use.

The Region

The Tarafeni is a west bank tributary of the Kansabati, originating in the hills of Bankura. The Tarafeni valley forms the northwestern corner of the district of Midnapur (with a small portion in Bankura) with an area of 450 sq km. The Tarafeni and its tributaries are perennial streams. The region has been divided for the purpose of this work into (i) the upland (Fig. 1) and (ii) the lowlying plain (Fig. 2). The upland constitutes the catchment area which is dominated by low Precambrian hills (250-290 m in height) outlining the western boundary and also forming the water divide between the drainage of the Kharsoti (a tributary of the Subarnarekha) and the Tarafeni. Cut across by numerous low order streams with their narrow valleys the land is highly dissected with active peneplanation at the foothills. Outcrops of quartz, schist, quartzite and granite form the other characteristic features of the landscape. The dissected upland levels down after Sinduria to a less rugged lowlying plain where the river spreads out in its middle and lower reaches and distinct terraces are seen on both banks. Tropical dry deciduous trees form the characteristic vegetation of the region.

Distribution of the Microlithic Sites

Out of 49 sites 33 are situated on the banks of the low order tributaries of the Tarafeni at the foot of the hills in the upland region (Fig. 1). The remaining are found on both banks of the main river in the lowlying plain (Fig. 2).

It was seen that the size of a site/scatter is not always commensurate with the number of artefacts present and this may be attributed to differential erosional processes, anthropogenic factors or past human behavior. Thus the classification of the sites was done on the basis of their respective artefactual yield — viz., small (4 to 50 specimens), medium (50 to 150 specimens) and large (150-600 specimens) — rather than the area over which the artefacts occurred.

Two parts of the landscape show a higher density of sites. These are the 4 km stretch from Kalapathar to Bamundiha and a stretch of 2.5 km from Kattara to Barighati. All the large sites are located in these two stretches. The rest of the sites/scatters are randomly spread out over the landscape. However, the archaeological record extends over an area of only 350 sq km in a region covering 450 sq km. After Enthela the distribution thins out and beyond Bhanraru there is a total absence of artefacts, the reasons for which are at present unknown.

No outcrops of the chief raw materials used in manufacturing the artefacts were found at the site/scatters or in their vicinity. Only quartz and a greenish grey quartzite which have minimal representation in the collection are locally available. Outcrops of black chert, cherty quartz, varieties of coloured chert, quartzite, chalcedony, grey chert and meta basalt that have been used in various quantities are absent. Dunn and Dey (1942) refer to the provenance of a few of these groups in the district of east Singhbhum, at a distance of 50 km from the Tarafeni valley. Outcrops of black chert and green quartzite were located at Jambani. Black chert also occurs as river pebbles in the channel bed at Gobradih where cobbles of greenish grey chert were seen near a rocky outcrop (Fig. 3).

However, in the absence of a more intensive survey we cannot rule out a source closer than those known 50 km away. Instances of long distance procurement of raw material are not rare though (Gould *et al.* 1971; Schild

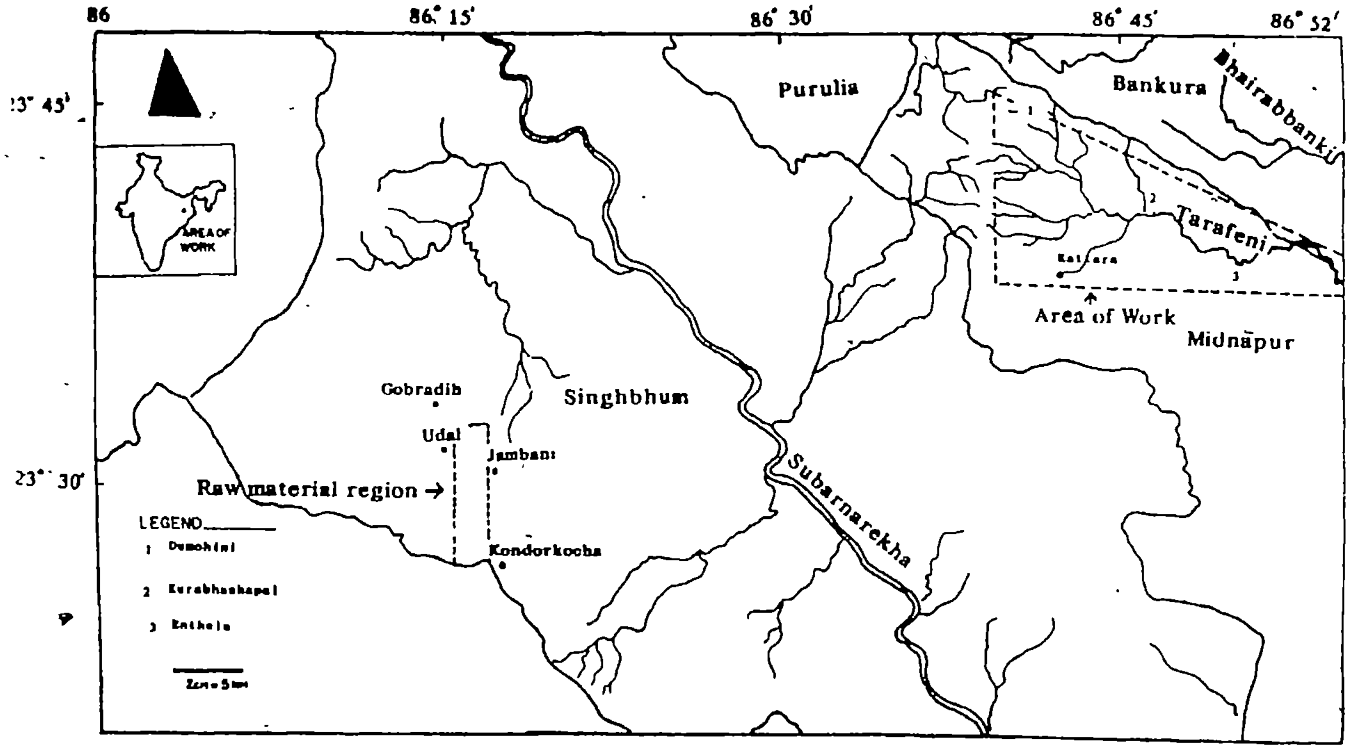

Fig. 3: Map of the raw material region with relation to area of work

1987; Morrow and Jefferies 1989; Kuhn 1992; Feblot-Augustines 1993) and this may be 'embedded' in other activities (Binford 1979). But here what emerges as significant is that this region has a high density of sites even though it is devoid of all the major groups of raw material.

Context of the Sites: Implications for the Palaeoenvironment

New facts on the palaeoenvironment of the region were revealed in a study of the context of the sites in relation to the local geology and palaeontology (Basak *et al.* in press).

The geological history of the region is characterised by the presence of outcrops of Pre-Cambrian rocks followed by the 'Pre-Tertiary to Early Tertiary (?)' Phulkusma Formation (Ghosh and Majumdar 1981, 1991) which is the primary laterite/residual soil over the Pre-Cambrian rocks. This is followed by the Bhairabbanki Formation represented by Mio-Pliocene sandstone and shale. The Quaternary deposits from the oldest to the youngest have been named the Lalgarh Formation, Sijua Formation, and Daintikri Formation. The present day flood plains are called the Bamandiha and Kasai surfaces (Ghosh and Majumdar 1981, 1991).

The microlithic sites of the Tarafeni valley consist of surface scatters of microliths derived from the eroded Quaternary deposits. During the 1993-95 field seasons lithological sections of six of the most important sites were documented. These are Dhuliapur (86°50'; 22°38'), Kurabhashapal (86°48'; 22°40'), Kaliam (86°52'; 22°37'), Majigara (86°41'; 22°43'), Ashri2 (86°42'; 22°43'), and Kaṇdarbhula (86°42'; 22°44').

Amongst these Dhuliapur is taken as the type section (Fig. 4) because it has the most complete exposure of the Lalgarh and the Sijua Formations.

The Quaternary alluvial fill at Dhuliapur forms a distinct terrace at a height of about 6 m above the present bed level of the Tarafeni where the section exposed on the right bank is as follows (from top to bottom):

The top 1.2 m is a thick reddish brown silt, the surface of which forms a terrace in this area. Iron slag is found on the surface of this silt and within 30 cm from the top with ash lenses, burnt soil and bone fragments.

Below this silt a microlith-yielding colluvial gravel occurs whose thickness could not be determined in the field.

The microlith-yielding gravel unconformably overlies a 1.5 m thick deposit of calcrete nodules and tubules (rhizoconcretions) in a greyish brown silty loam. At the other five sites the colluvium is seen to cap the calcrete directly. The calcrete nodules observed on the surface are in fact lag concentrates derived from this unit. Fragmentary and slightly abraded animal fossils are associated with this unit, mostly on the surface of the calcrete.

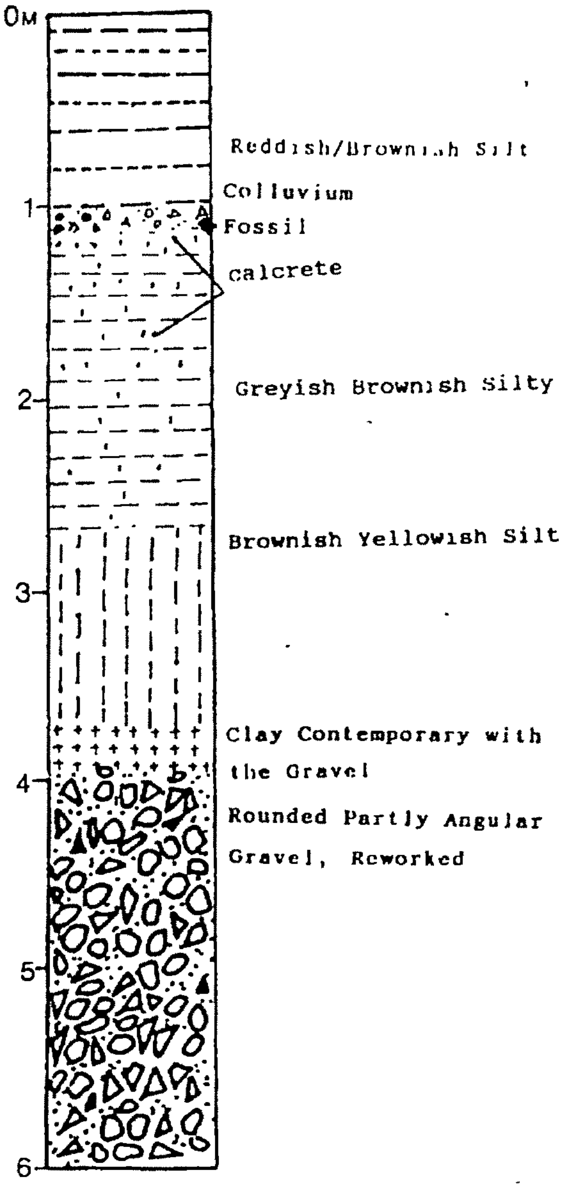
0M
1
2
3
4
5
6
Reddish/Brownish Silt
Colluvium
Fossil
calcrete
Greyish Brownish Silty Loam
Brownish Yellowish Silt
Clay Contemporary with the Gravel
Rounded Partly Angular Gravel, Reworked

Fig. 4: Lithological section at Dhuliapur

A 1.3 m thick brownish yellow clayey loam, mottled and oxidised by the development of desiccation cracks underlies the greyish brown silty loam.

The basal 2 m consists of a moderately consolidated gravel consisting of rounded to sub-rounded cobbles, pebbles of vein quartz, quartzite, sandstone and some metamorphosed basic rocks. It is a moderately sorted, clast supported gravel which is cemented by calcareous material.

The lower 2 m of the Dhuliapur section has been designated as the Upper Lalgarh Formation (Ghosh and

Majumdar 1981, 1991). A few Lower Palaeolithic artefacts have been recovered from this formation by earlier workers (Ghosh 1962). The upper 4 m of the Dhuliapur section is less thick and bears a striking resemblance to the type site observed at Sijua. The trial pits taken in the other five sections (Basak *et al.* in press) reveal an almost similar stratigraphy.

To summarise, all the sites are uniformly associated with an artefact-bearing colluvium which is underlain by a calcrete horizon and overlain by an oxisol. On the surface both the calcrete and the colluvium occur as lag deposits after the associated soil matrix had been stripped off. The time gap between the deposition of the calcrete and the colluvium could not be precisely determined. But what emerged positively at all the sites was their close association and hence it is surmised that a very short time must have elapsed between the deposition of the two. The overlying oxisol, typical of a weathering profile in a tropical humid region, is uniformly present, varying in thickness between 1.2 to 2.7 m.

Vertebrate fossils were collected from the surface of the calcrete at Dhuliapur. Though fossils from Dhuliapur were reported previously (Ghosh and Majumdar 1981, 1991) their association vis à vis the geology and archaeology was not clearly defined. The formation of pedogenic calcrete in a sub-humid region with an annual rainfall of 1600-2000 mm is very significant from an environmental perspective. The distribution of calcrete is more widespread in the drier parts of the world with limited precipitation (Reeves 1976; Goudie 1983; Thomas 1994). The limit for calcrete varies from area to area but generally it lies in the zone where the annual precipitation is between 400 and 600 mm (Goudie 1983). In India calcrete is found in the semi-arid tracts of Rajasthan, Maharashtra, Gujarat and north Karnataka where the annual precipitation is less than 700 mm and where the evapo-transpiration ratio is very high. Calcrete does not form in a climate characterised by such a high rate of precipitation i.e., 1600-2000 (Reeves 1976; Goudie 1983). The nature of this calcrete is nodular and Reeves specifies that such calcretes are indicative of an annual precipitation rate of 560 mm per year.

The Fluorine/Phosphate ratio was determined for 10 bone samples. The majority of the bones collected from the surface of the calcrete give an F/P value of 3-5 thus suggesting the age of the formation to be the Terminal Pleistocene (Kshirsagar and Badam 1990). The animal fossils from Dhuliapur belong mainly to grazing species like black buck (*Antilope cervicapra*) spotted deer (*Axis axis*) and *Bos namadicus*. Similar finds of fossils have been made from several river basins in parts of the Bankura, Burdwan and Purulia districts of West Bengal which adjoin the Tarafeni valley to the north and northwest (Das Sarma *et al.* 1982). On the basis of the stratigraphy drawn up at the six major sites the microlithic context was then correlated with the semi-arid grassland situation in the Terminal Pleistocene.

The Terminal Pleistocene (18,000-10,000 B.P.) coincides with the maximum extension of most of the continental ice sheets. Evidence of aridity has been documented from north and west India where the present climate is arid to semi-arid, but such evidence is all the more striking when it relates to the humid to sub-humid regions of eastern India, as in Meghalaya (Medhi 1981), Manipur (Singh 1987; Chanda and Bhattacharya 1987), Mirik Lake, Darjeeling (Sharma and Chauhan in press) and South Bengal basin C.S. Chanda: personal communication). The lower salinity gradient of the Indian Ocean (Duplessy 1982) and a low sea surface temperature in the Bay of Bengal and over much of the Indian Ocean (Prell *et al.* 1980) during the same period are additional evidence for Late Pleistocene aridity.

Artefact Analysis: Methodology

The manufacture of chipped stones, in this case, blade cores, involves certain fundamental steps which are broadly defined as: acquisition of raw material either from local sources or imported from non-local zones; the preparation of the core and initial reduction from the nodule either at the locus of acquisition or when transported to another locality; the removal of the blades, which as end-products may either be individually used or are retouched and inserted into hafts for use; discard. Rejuvenation of the core and the re-use of blades and flakes may also occur. The by-products accumulating through all these stages would be a series of debitage flakes that may or may not be utilized. These different stages in tool making, use and discard may occur at one place and time or at different places and times. What is attempted here is a broad understanding of these reduction steps seen at the sites as an index of human behaviour rather than a detailed analysis of the blade reduction technique *per se*.

In a region marked by the absence of the major sources of raw material the first imperative was to see to what extent initial trimming was present in the archaeological record. This was assessed from (i) the number of raw material blocks present and (ii) from the presence of cortex on flakes which is a sure indicator of initial trimming (Magne 1989). Cortical flakes were again subdivided into primary cortification flakes with 100% cortex cover, secondary cortification flakes with more than 50% cortex cover (Koldehoff 1987) and flakes with less than 50% cortex cover.

Next, the representation of the post-initial trimming phase at the various sites was seen. Blade cores are usually seen as a standardized reduction technique excellent for conserving high quality raw material because a large quantity of tool edge can be produced in relation to the amount of material (Clark 1987; Hoffman 1987; Morrow 1987; Parry and Kelly 1987). The cores were classified according to their length and their state of exploitation, whether minimally used, well exploited or exhausted (Johnson 1975: 78). An estimate of the level of exploitation of the cores would show in what state the cores were discarded at the site.

As all the flakes are mainly a by-product of the blade reduction process a comparative ratio of the number of cores and flakes would show whether more cores were brought to the site or less cores were discarded, some being taken away. For example, a core/flake ratio of 1:1 would mean that the flaking debitage was less compared to the number of cores present, some of which may have been brought for repair or post-initial stage reduction, some may have been just discarded. A higher percentage of flaking debitage to cores would mean that either less cores were discarded at the site or more intensive reduction was present (Byrd 1989: 34). The state of exploitation of the cores and the nature of the flakes need also to be taken into consideration here.

The rejuvenation of a core through restoration of the platform angle or the desired platform edge could be seen in a high incidence of rejuvenation flakes. Worn out or broken implements could also be modified or transformed into other forms, such as the transformation of worn out cores into burins (or scrapers).

An assessment was also made of the nature and extent of utilization of the debitage, chiefly flakes Two types of utilization were seen. Serration marks present on the margins of the flakes were classified as use marks and were differentiated from deliberate retouching. Deliberate modification of the shape of the flakes was seen in a few cases. These were classified as 'used' and differentiated from retouching. The status of those utilized flakes that were larger than the existing cores at a site could not be precisely determined. They could either have been a part of the debitage on the site or they may have been brought to the site for use. Finally, the nature of the blades was noted. Traces of preliminary reduction were looked for in the blades to evaluate whether they were 'first series' (Johnson 1983: 54). The degree of their utilization was assessed. In the absence of micro-wear studies, only blades with definite retouch or backing were designated as utilized, although 'use' marks present on the blades were taken note of. The ratio of blade scars to number of blades was also noted.

A great deal of variation was seen in the utilization of raw materials which were classified into six groups. The differential usage of these groups was taken note of to see whether any particular group was ubiquitous, whether some were present only in certain locales and absent in others, whether all the reduction stages were represented equally in all the groups.

Artefact Analysis: Results and Inferences

Absence of Initial Trimming

Initial trimming is virtually non-existent in the assemblages as seen from the negligible number of raw material blocks, only 22 (0.5%) (Table 1) which is very low compared to the number of cores present i.e., 541 (14.2%) (Fig. 5). The number of cortical flakes is also insubstantial, only 417 (24.5%) out of 1699 flakes. Even amongst these, primary decortification flakes (with 100% cortex cover) and secondary decortification flakes (with more than 50% cortex cover) are only 14 (0.8%). All the rest have a cortex cover of less than 50% (Fig. 6; Table 2). These facts show that these sites are characterized by the absence of on-place reduction of nodules. Possibly partially decorticated cores were imported into the region along with some trimmed nodules which were also used for blade reduction. Such evidence of importation in a raw material scarce region is not uncommon (Camilli 1988). Ethnographic studies show that the initial shaping of cores for blanks or the production of blanks for specialized tools usually takes place at the quarry (Gould 1978; Binford and O'Connell 1984). At the Late Palaeolithic site of Baghor I in the Son valley the assemblage chiefly consists of debitage flakes- mostly cortical (69.5%), chunks (12.7%) and large and thick blades and blade fragments, many with cortex on their dorsal surfaces. These are, according to the authors, largely the product of the initial stages of manufacturing, the finished products being taken away elsewhere (Kenoyer *et al.* 1980). Blade cores are small, lightweight and easily portable; a hallmark of very mobile populations (Ebert 1979). The nominal number of cortical flakes (with less than 50% cortex cover) suggests that these cores were worked at various places and transported around as part of the tool-kit, subsequent to the initial stages of trimming.

Representation of the Post-initial Trimming Phase

Although all the cores were not discarded in an absolutely worn out state, the majority show a high degree of exploitation through intensive reduction (Table 3).

All this evidence points to an advanced preparation of tools in anticipation of future use, characteristics of a curated technology (Binford 1977, 1979). On the other hand, once prepared, blade cores can facilitate the easy removal of flakes when needed. Thus stockpiled cores could have been reused to extract blades expediently to meet shortages of raw material. Viewed from this perspective the cores may also be seen as a part of an expedient technology which signified the manufacture, use and discard of tools at the time and place of use (Binford 1977, 1979). The trimmed nodules, being more bulky, possibly

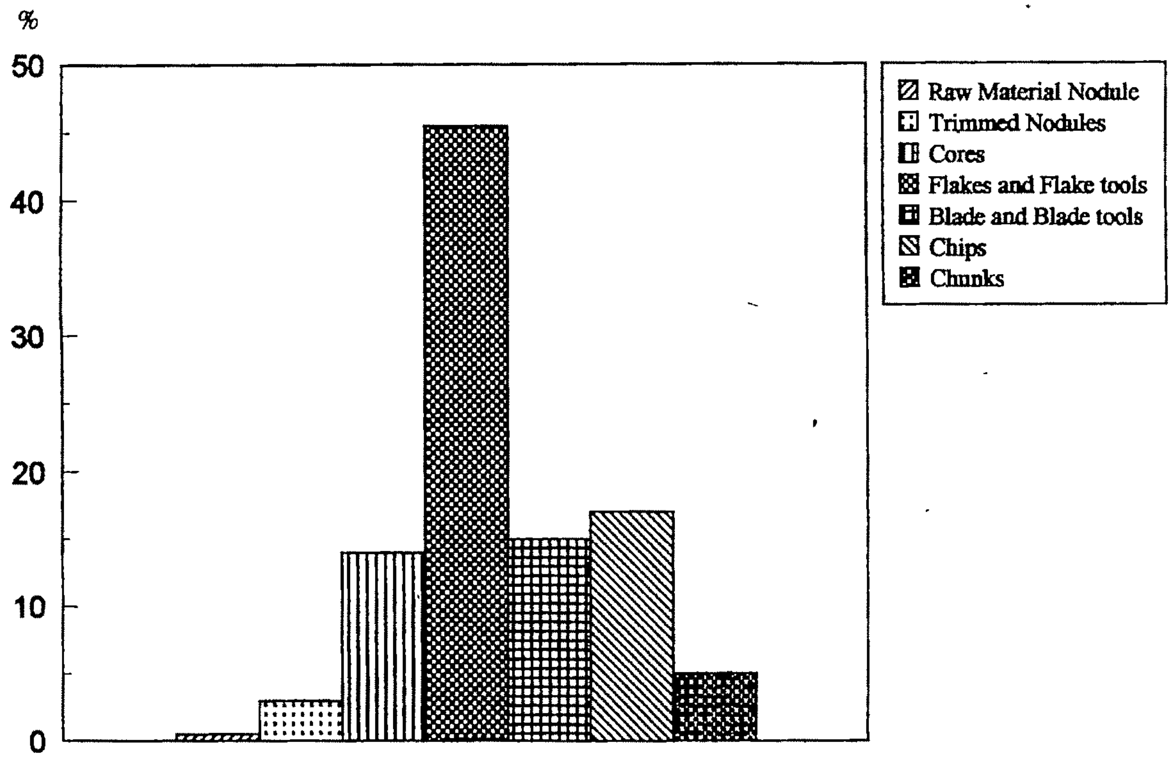

Fig. 5: Artefact groups

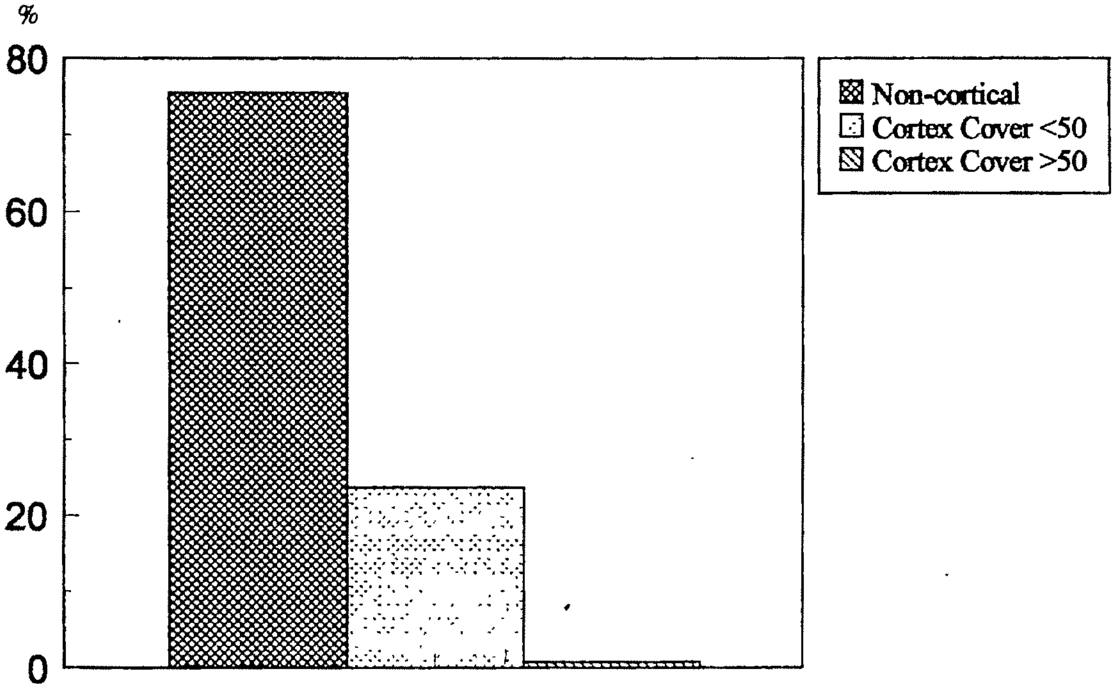

Fig. 6: Cortex on flakes

Table 2: Sitewise distribution of the cores in different stages of exploitation

Site	Minimally Used	Well Exploited	Exhausted	Not Used	Total
Kurabhashapal	6	34	19	1	60
Baishnabpur 1	6	14	21	2	43
Baishnabpur 2	16	22	15	1	54
Ghagra	3	12	5	0	20
Kalapathar	0	7	2	0	9
Balidanga	4	5	2	0	11
Dhuliapur	7	13	6	0	26
Enthela	7	8	2	0	17
Jallangdih	0	0	0	0	0
Bamundiha 1	0	6	0	0	6
Pukhuria	0	2	1	0	3
Bamundiha 2	0	0	2	0	2
Rajdoha	0	1	1	0	2
Gopalpur	0	1	3	0	4
Kantharpal	0	2	2	0	4
Kaliam	1	3	2	0	6
Mohanpur	0	1	2	0	3
Kattara	3	20	13	0	36
Aguibil 2	16	19	1	0	36
Benghuta	1	6	2	0	9
Barighati 1	3	1	1	0	5
Barighati 3	3	1	2	0	6
Majigara	3	12	5	1	21
Ashri 1	2	6	5	0	13
Srinathpur	4	2	7	0	13
Gidighati	9	5	3	0	17
Aguibil 1	0	1	3	0	4
Gohalberia 1	2	1	4	0	7
Gohalberia 2	1	5	2	0	8
Patpinra	0	1	3	0	4
Barighati 2	4	3	1	0	8
Barighati 2 extension	2	1	1	0	4
Akuldoba	0	2	4	0	6
Dongardihi	0	3	2	1	6
Dumohani	2	2	1	0	5
Pataghar	1	1	0	0	2
Barapal	0	1	0	0	1
Kandarbhula 1	1	0	2	0	3
Kandarbhula 2	0	0	0	0	0
Susnijobi	1	1	0	0	2
Kasijora	0	0	5	0	5
Ashri 2	2	0	0	0	2
Adargaria 1	1	2	3	0	6
Adargaria 2	1	3	2	1	7
Joram	0	0	0	0	0
Amadubi	0	0	0	0	0
Madhupur	0	1	1	0	2
Charakpahari 1	0	1	6	0	7
Charakpahari 2	0	0	6	0	6
Total	112	232	170	7	521

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Table 3: Sitewise distribution of the blade scar/blade ratio

Site	Blade Scar/Blade Ratio
Kurabhashapal	317:280
Baishnabpur1	129:36
Baishnabpur2	195:34
Ghagra	67:4
Kalapathar	53:10
Balidanga	46:9
Dhuliapur	130:26
Enthela	50:20
Jallangdih	-
Bamundiha1	20:9
Pukhuria	-
Bamundiha2	9:7
Rajdoha	-
Gopalpur	12:2
Kantharpal	-
Kaliam	21:2
Mohanpur	-
Kattara	209:12
Aguibil2	174:18
Benghuta	53:3
Barighati1	21:10
Barighati3	17:1
Majigara	90:2
Ashri1	49:1
Srinathpur	35:9
Gidighati	46:2
Aguibil1	-
Gohalberia1	22:1
Gohalberia2	-
Patpinra	-
Barighati2	32:4
Barighati2 extension	10:1
Akuldoba	23:3
Dongardihi	-
Dumohani	10:2
Pataghar	3:3
Barapal	-
Kandarbhula1	4:2
Kandarbhula2	-
Susnijobi	-
Kasijora	-
Ashri2	2:3
Adargaria1	-
Adargaria2	-
Joram	-
Amadubi	-
Madhupur	-
Charakpahari1	-
Charakpahari2	-

remained stationary at one place after being brought to the site, and could have also served as stockpiled sources of raw material for the expedient removal of blades as and when required.

The accumulation of flakes resulted as a by-product of the blade manufacturing process. Use-wear marks on many of these flakes show an expedient use prior to their discard. At some sites large manufacturing flakes are found for which the corresponding cores are absent. Some of these flakes with use marks may possibly have been carried around for short distances and discarded away from their place of use Evidence of the use of unretouched flakes as knives and cutting implements are not unusual among hunter-gatherer groups (Allchin 1966; Mulvaney 1975; Camilli 1988). Retouched flakes are few and only concentrated in a few sites. It is difficult to say whether they were used and discarded at these sites or whether their locality of use was different and they were discarded here mainly for repair.

Only 14% of the total assemblage from all the sites represents blades (Fig. 5; Table 3) of which half are present at Kurabhashapal, while according to Datta (1995) a substantial number of blades are also present at Kattara, Ghagra, Dhuliapur and Barapal. Thus it seems that blades and blade tools are found in bulk only at a few sites. These are all late series blades and none show traces of preliminary manufacture. Blades are small, light instruments that are more prone to wear and tear and loss as they are carried around by people on the move (Ebert 1979). Moreover, as Keeley (1982) has shown, blades when hafted are seldom discarded at the place of their use, but only at places where retooling of the haft took place. This may be the cause for the bulk of blades being concentrated at only a few sites Blades and blade tools cannot be designated as curated items as these are prone to breakage or rapid wear and have brief use lives (Keeley 1982). Moreover, the unhafted elements may be discarded at the place of use. Thus these items are just seen as end-products of the reduction process.

The on-site reduction of chunks for blades is seen at some sites. These show expedient working as different from the careful preparation of the cores and trimmed nodules and may be looked upon as 'situational devices' (Binford 1979) to meet certain needs.

Thus, what is seen here is how different strategies of tool use were interwoven in a region where raw material was scarce. Different items are seen here as reflections of different strategies, each having a different role to play in the entire functioning system. For example, cores were curated items, they were also possibly reused, subsequently becoming a part of an expedient strategy. In contrast, waste flakes do not appear to have been curated but expediently used and discarded at the place of use

Table 4: Distribution of various raw materials at the sites as seen in the different artefact groups (excluding chips)

Site	**Black Chert**	**Coloured Chert**	**Grey Chert**	**Chalcedony**	**Quartz Basalt**	**Quartzite**	**Meta**	**Total**
Kurabhashapal	184	35	166	4	5	10	135	546
Baishnabpur 1	190	9	22	0	10	53	6	290
Baishnabpur 2	260	14	44	1	3	1	16	339
Ghagra	48	1	18	1	8	0	6	82
Kalapathar	41	1	3	0	0	0	0	45
Balidanga	34	3	19	0	2	0	1	59
Dhuliapur	62	2	55	0	0	3	5	127
Enthela	212	1	2	0	2	21	0	238
Jallangdih	45	3	17	0	2	3	0	70
Bamundiha 1	39	1	6	1	2	16	0	65
Pukhuria	1	0	1	0	0	1	0	3
Bamundiha 2	19	0	4	1	0	1	0	25
Rajdoha	2	0	2	0	0	0	0	4
Gopalpur	6	1	5	0	1	0	2	15
Kantharpal	10	0	0	0	0	0	0	10
Kaliam	14	0	3	0	1	0	0	18
Mohanpur	8	0	2	0	0	0	0	10
Kattara	126	8	22	2	12	15	26	211
Aguibil 2	154	52	14	0	0	1	0	221
Benghuta	23	5	6	1	3	4	7	49
Barighati 1	40	0	2	0	1	1	1	45
Barighati 3	31	2	13	0	7	0	1	54
Majigara	48	1	17	0	4	1	0	94
Ashri 1	60	0	4	0	0	4	0	68
Srinathpur	29	0	10	0	0	11	1	51
Gidighati	39	0	2	0	0	0	0	41
Aguibil 1	3	4	1	0	2	1	2	13
Gohalberia 1	17	0	3	0	2	4	5	31
Gohalberia 2	18	0	2	0	0	0	0	20
Patpinra	7	0	1	0	0	0	0	8
Barighati 2	24	1	1	0	0	0	3	29
Barighati 2 extension	11	1	1	0	0	2	0(tab)15	
Akuldoba	10	1	0	4	1	6	0	22
Dongardihi	5	0	6	0	0	0	1	12
Dumohani	5	1	15	0	0	0	0	21
Pataghar	11	0	5	0	1	0	0	17
Barapal	5	0	5	0	0	0	0	10
Kandarbhula 1	3	0	8	0	0	0	0	11
Kandarbhula 2	0	0	2	0	0	0	2	4
Susnijobi	4	0	4	0	0	0	0	8
Kasijora	8	0	5	0	0	0	0	13
Ashri 2	12	0	0	0	0	0	0	12
Adargaria 1	6	0	6	0	0	0	0	12
Adargaria 2	8	1	0	0	0	0	0	9
Joram	7	1	1	0	0	0	0	9
Amadubi	3	0	0	0	0	0	0	3
Madhupur	6	0	1	0	0	1	1	9
Charakpahari 1	11	0	0	0	0	0	0	11
Charakpahari 2	8	0	0	0	0	0	0	8
Total	1917	149	526	15	69	160	221	3087

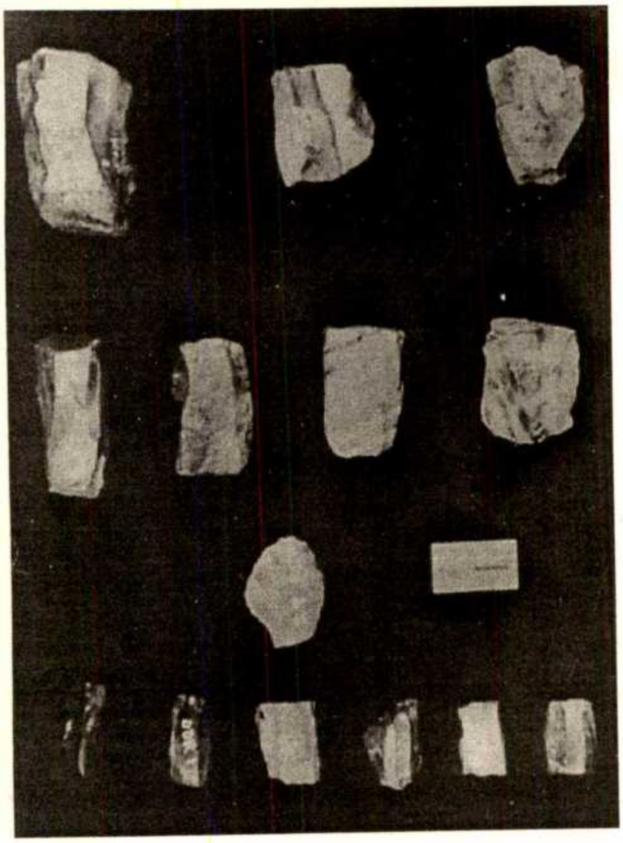

Fig. 7: Blade cores in different stages of exploitation

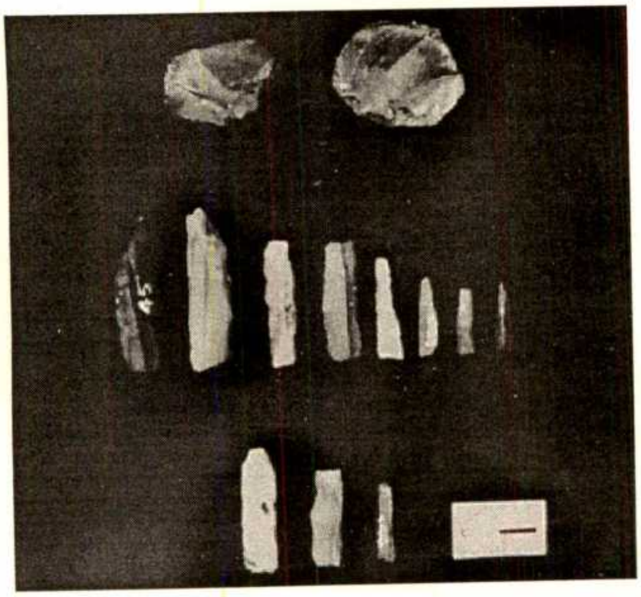

Fig. 8: Rejuvenation flakes, burins, blades and points

Exploitation of Different Groups of Raw Materials

Various groups of raw material were exploited though black chert, cherty quartz and grey chert were the most preferred groups (Table 5). On the basis of present data it is

Table 5: Sitewise distribution of the core/flake ratio

Site	**Core/Flake Ratio**
Kurabhashapal	60:128 (1:2)
Baishnabpur 1	43:165 (1:4)
Baishnabpur 2	54:176 (1:3)
Ghagra	20:42 (1:2)
Kalapathar	9:19 (1:2)
Balidanga	11:30 (1:3)
Dhuliapur	26:58 (1:2)
Enthela	17:174 (1:10)
Jallangdih	-
Bamundiha 1	6:40 (1:7)
Pukhuria	-
Bamundiha 2	2:13 (1:7)
Rajdoha	2:2 (1:1)
Gopalpur	4:3
Kantharpal	4:5 (1:1)
Kaliam	6:6 (1:1)
Mohanpur	3:7 (1:2)
Kattara	36:102 (1:3)
Aguibil 2	36:116 (1:3)
Benghuta	9:28 (1:3)
Barighati 1	5:21 (1:4)
Barighati 3	6:36 (1:6)
Majigara	21:37 (1:2)
Ashri 1	13:38 (1:3)
Srinathpur	13:25 (1:2)
Gidighati	17:20 (1:1)
Aguibil 1	4:4 (1:1)
Gohalberia 1	7:14 (1:2)
Gohalberia 2	8:10 (1:1)
Patpinra	4:4 (1:1)
Barighati 2	8:8 (1:1)
Barighati 2 extension	4:5 (1:1)
Akuldoba	6:5
Dongardihi	6:6 (1:1)
Dumohani	5:11 (1:2)
Pataghar	2:8 (1:4)
Barapal	1:8
Kandarbhula 1	3:5 (1:2)
Kandarbhula 2	-
Susnijobi	2:6 (1:3)
Kasijora	5:8 (1:2)
Ashri 2	2:6 (1:3)
Adargaria 1	6:6 (1:1)
Adargaria 2	7:2
Joram	-
Amadubi	-
Madhupur	2:6 (1:3)
Charakpahari 1	7:4
Charakpahari 2	6:2

difficult to explain the diversity in raw material utilization, or the special significance attached to some groups, as seen among the Western Desert aborigines of Australia (Gould 1978, 1980; Gould and Saggers 1985). Nor is it possible to say whether different forms of procurement were associated with different groups of raw material. The recent archaeological and ethnographic studies of Binford and others (as referred to above) show that raw material procurement was embedded in other activities which is maintained here.

Patterns of Variability Among Sites

Much variability was also noticed among assemblages present at the sites, thus reflecting diverse patterns of use. Kurabhashapal, Baishnabpur 1, Baishnabpur 2, Kattara, Ghagra and Dhuliapur are characterised by a high concentration of artefacts, a substantial discard of cores showing an overall intensive use, a low amount of reduction as seen from the core/flake ratio (Table 6), the presence of a high percentage of blades and flake tools at four sites (Datta 1995), the presence of diverse groups of flakes and a varied representation of raw materials. Such a concentration of artefacts showing considerable diversity possibly resulted either from frequent, repetitive visits to the sites and/or through prolonged use of them. Intensive use of stockpiled cores and trimmed nodules at these sites (but mostly at Kattara) was possibly an outcome of these processes. The accumulation of blades at only these few sites was perhaps the effect of frequent retooling of the haft that may have been taking place here. These sites located mainly in two stretches appear to have been the most preferred locales. The maximum concentration of sites are also seen in these stretches. Many of them were possibly satellite locations attached to the large sites. On the other hand, utilization of cores and, to some extent, the trimmed nodules appear to be the chief distinguishing features among all the sites. Scavenging may be suggested as one of the possible causes for this. Archaeological and ethnographic studies have shown that previously discarded materials might be scavenged to meet the scarcity in a lithicless region (Camilli 1988; Wandsnider 1989; Camilli and Ebert 1992; Horne and Aiston cited in Kelly 1988). As mentioned above, cores once prepared may facilitate the expedient removal of flakes as and when required. Thus, places showing a greater number of intensively used cores may have been subjected to greater scavenging than places showing a lesser number. Of course, more detailed studies of the archaeological and geological deposits are required for a better understanding of these processes.

These sites are again differentiated from the ephemeral scatters which are more numerous and distributed throughout the landscape. Ethnographic examples of such off-settlement, temporary activity are many (Foley 1981; Hayden 1978). Here the scatters are marked by discarded cores and a very small quantity of debitage flakes. The cores were possibly discarded after flake removal while the activity of core reduction remained nominal.

Concluding Remarks

It is therefore surmised, that the Tarafeni valley was quite intensively exploited, perhaps routinely over a certain length of time in the Terminal Pleistocene when the climate was more arid than at present. It is not possible as yet to state why the region was important to prehistoric populations inspite of the absence of the major raw material groups. One might however, suggest that seasonal availability of resources, accessibility of water in a semi-arid environment and other non-subsistence factors may have been important (Kelly 1995). Perhaps such answers cannot be given. As Torrence (1994) maintains "prehistorians have (often) favoured events in their explanations, perhaps this is what we humans experience in our own lives. In contrast, processes which extend beyond a single lifetime are more difficult to envisage."

For the Tarafeni these difficult questions have only been addressed through a systematic investigation of a region that has so far seen only sporadic explorations. Hopefully the recognition of these complexities is a prelude to a deeper future understanding of the prehistory of the Tarafeni valley and its neighbouring regions.

Acknowledgements

I wish to acknowledge the following people who helped me in achieving this goal: Prof. V.N. Misra for his critical comments, Prof. S.N. Rajaguru under whose tutelage I could do the geomorphological work. Dr. Sheila Mishra and Dr. G.L. Badam for helping me in the work on stone tools and bones, respectively, Prof. K. Paddayya and Dr. M.D. Kajale for many useful comments, Dr. A. Kshirsagar for dating the bones and helping me with my samples; Dr. V.G. Gogte and Mr. B. Deotare for chemical analysis. Help and co-operation received in the field from Dr. Gautam Sengupta, Dr. R.N. Ghosh, Mr. Haru Bhattacharya, Mr. Badol Patra, Bishwanath Samanta, Preeti Ganesh and the Police administration, Midnapur and East Singhbhum is gratefully acknowledged.

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Dwellings or Granaries? the Pit Phenomenon of the Kashmir-Swat Neolithic

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Abstract

In the light of recent methodoligical and theoretical developments applied to the pit phenomenon in British Iron Age archaeology, the pit "dwellings" of the Kashmir-Swat Neolithic are reassessed and a new hypothesis presented for their function.

Introduction

During the expansion of the first food-producing communities within South Asia, a particular culture complex emerged in the fourth millennium B.C. in the northern valleys of the Subcontinent. Commonly referred to as the northern Neolithic (Agrawal 1982; Allchin and Allchin 1982) or the Kashmir-Swat Neolithic (Parpola 1994), this complex is identified by pit dwellings, dog burials, ground stone axes and rectangular holed sickles. First discovered in the Kashmir valley in the 1950s, more recent evidence suggests that it extends as far as the Swat valley (Stacul 1994). Many scholars have been struck by its similarity with aspects of the Neolithic of Inner Asia; in particular, its holed or notched sickles, dwelling pits and jade beads have been found in a number of Chinese Neolithic sites (Stacul 1994). Building on these strong archaeological similarities, some scholars have even suggested that the inhabitants of the Kashmir-Swat Neolithic may have been speakers of a Sino-Tibetan language (Parpola 1994: 142). Amongst the most important lines of research arising from the study of this culture complex is the identification and interpretation of the pit phenomenon. The larger pits are currently interpreted as dwellings; this paper will offer an alternative model by reassessing them in the light of recent methodological and theoretical developments applied to a similar pit phenomenon in British Iron Age archaeology.

The Evidence

There are over 40 South Asian sites which share these cultural traits; unfortunately, only three sites have been excavated and published to any extent. These sites are Burzahom (*IAR* 1961-62, 1964-65) and Gufkral (Sharma 1982) in Kashmir and Loebanr III and Kalako-deray in Swat (Stacul 1977, 1993, 1995). The first site to be excavated, Burzahom, remains the type site of this culture complex, but the excavation report from the 1960s is still pending and undoubtedly fresh excavations are needed to fully understand its sequence. Most of the available descriptions of the site's sequence and features are brief, and there is little data available as to the precise fills of the various pits (*IAR* 1961-62). During the first season, a series of flat-bottomed, circular and oval pits was excavated containing ashy deposits which the excavators interpreted as "human occupation" (*IAR* 1961-62). A further 16 pits were excavated during the second season, of which the largest was bell-shaped, measuring 4.57 m in diameter and 3.96 m in depth (*IAR* 1964-65). Plastered with clay, a number of these pits were also reported as containing stone hearths (*IAR* 1964-65). In addition to the larger pits, a number of shallow pits, measuring between 0.6 m and 0.91 m were also excavated (*IAR* 1964-65). At the end of this occupation, it appears that all the pits were filled and sealed, and replaced by rectangular structures built on the surface. The pits have been dated to between c.3000-1550 B.C. whilst the surface structures have been dated to between c.1700-1550 B.C. (Sharif and Thapar 1992).

Similar pits were found in the valley of Swat at the sites of Kalako-deray and Loebanr III (Stacul 1977, 1994). The latter was excavated in 1976; a total of 9 large pits and a number of smaller ones were identified and excavated in

Trench A (Stacul 1977). The large pits were divided into three groups; one shallow, large pit (Hut A), one deep, medium-sized pit (Pit 1) and 7 shallow, medium-sized pits (Pits 2, 3, 4, 5, 6, 7 and 8). The published pit sections demonstrate that it is possible to make sub-divisions in terms of pit shape: bell-shaped, irregular, barrel-shaped and concave (Stacul 1977: 231-232). Further differences can be observed: for example, Pit 1 was the only one to have been plastered (Stacul 1977: 232). Whilst the basal fills of most pits appear to be similar — a fine, grey, sandy clay, a number had significantly different contents in subsequent fills. Pit 1, for example, contained indicators of a fireplace, 5 bone objects, 1 human terracotta figurine, 6 ceramic vessels and animal bones in layer 6; Pit 2 contained 11 ceramic vessels, 5 miniature ceramic vessels, 2 human terracotta figurines, 1 stone celt, 1 grinding stone, three bone objects and animal bones in layer 5; Hut A contained a large fireplace, 24 ceramic vessels, 3 miniature ceramic vessels, 7 bone objects, 2 human terracotta figurines, 10 animal terracotta figurines, 6 terracotta objects, 1 stone celt, 1 jade bead and animal bones in layer 4 (Stacul 1977: 232-234). Although circular alignments of postholes could be traced around some of the medium-sized pits (Stacul 1977), no such features could be detected around the largest, Hut A. The discovery of numerous fragments of daub within the excavations suggested to Stacul that "the use of roofing structures of reeds and stakes has been attested" (Stacul 1977: 234-5). As at Burzahom the pit structures were filled and sealed by rectangular walled structures on the surface.

The second of the Swat valley sites, Kalako-deray, provides the most detailed data. It was excavated between 1989 and 1993 and has revealed remarkably similar features and fills (Stacul 1993, 1995). Seven areas were excavated, of which 6 yielded evidence of large pits, contemporary in date with those at Loebanr III. Four pits were excavated in Area A (Stacul 1993) — A1, A3, A9 and A11; they varied in diameter between 1.6 m and 2.2 m, and in depth between 1.4 m and 0.5 m (Stacul 1993). A further 2 pits, B5 and B7, were excavated in Area B. Pit B5 measured 2.5 m in diameter and whilst the upper fill contained 2 rectangular holed sickles, the lower fill contained potsherds, miniature ceramic vessels, stone axes, bone artefacts and grinding slabs (Stacul 1993). Pit B7 was paved in schist slabs, measuring 4.7 m in diameter and 3.6 m deep, and contained ceramic vessels, miniature ceramic vessels, bone artefacts, hammer axes and grinding slabs (Stacul 1993). It is interesting to note that, unlike at Loebanr III, no postholes were identified (Stacul 1993). During the 1992 and 1993 seasons 3 new areas were opened — B1, B2-B3 and C, of which all but the latter revealed large pits in the earliest phases (Stacul 1995). Eleven pits were identified and excavated in Areas B1 and B2-B3, ranging between 2.7 m and 1.4 m in diameter and between 0.55 m and 1.4 m in depth (Stacul 1995). Although special or small finds were recovered from the fills of almost every pit, two are described here as they demonstrate a great similarity with finds from Pits 1 and 2 and Hut A at Loebanr III (Stacul 1977). Kalako-deray Pit B17, measuring 2.7 m in diameter and 1.45 m in depth, contained 1 holed rectangular sickle, 1 stone axe-hammer, 3 stone balls, 2 grinding slabs, 1 ceramic vessel, 2 terracotta animal figurines and animal bones; Pit B18, measuring 2.3 m in diameter and 1.4 m in depth, contained 1 rectangular sickle or saw, 1 hammer-axe, 1 grinding slab, 1 mortar, 4 ceramic vessels, 1 miniature ceramic vessel and animal bones (Stacul 1995). All the large pits from the Swat valley sites are attributed to Period IV of the Ghalegay sequence, and thus date to between c.1700-1400 B.C. (Stacul 1994).

Current Interpretations

The excavators of Burzahom were in little doubt as to the function of the bell-shaped pits stating that "dwelling pits of Period I were invariably cut into the Karewa soil... while postholes on the periphery of the mouth suggest the likelihood of a superstructure of perishable material" (*IAR* 1964-65). They further suggested that during the winter the inhabitants of the settlement lived in the pit-dwellings cut into the loess and that during the summer they lived above ground (Bala 1978). This identification was further stressed in attempts to summarise the main aspects of the Kashmir-Swat Neolithic (Sharif and Thapar 1992; Allchin and Allchin 1982); Agrawal stated that the "Pit dwelling is the most distinctive trait of Period I (at Burzahom)" and that "Deeper pits must have been used during the winters when the valley becomes snowbound" (Agrawal 1982: 98). Moreover, as most of the 45 excavated 'pit-chambers' were located in the centre of the site and the 37 smaller pits were on the peripheries it has been suggested that this represents differing social affiliation, with one group in one type of pit and another group in another (Sharif and Thapar 1992). It is clear from the title of the 1976 Loebanr III report that a dwelling function was also attributed to the various pits encountered there (Stacul 1977). Indeed, the commentary summarises the evidence presented and states that feature A was "used for dwelling purposes and probably as sleeping quarters"; Pit 1 was originally a storage pit and then reused as "a fireplace and maybe for other dwelling activities"; Pits 2 and 5 formed one composite room and "it seems evident that the artefacts and faunal remains at the base of layer 5 are indicative of intensive settled activity"; Pit 4 was a fireplace but the functions of Pits 3, 6, 7 and 8 were unclear (Stacul 1977: 250). The 1993 report of Kalako-deray again stresses the dwelling nature of a number of the excavated pits stating that the discovery of faunal and floral remains within their fills suggested "intensive occupation of the cavities" (Stacul 1993: 89) Furthermore, it stresses similarities between the Swat valley pits and the 'Dwelling-pits' of 'Inner Asia' (Stacul

1993). In a later synthesis Stacul concludes that whilst the function of all of the excavated pits remains in debate "the large cavities featuring floor-levels, fireplace remains and a set of finds such as jars, vessels, miniature pots, stone tools and clay figurines, mostly suggest a dwelling place" (Stacul 1994: 708). It is thus clear that most scholars have accepted the 'dwelling' hypothesis for the function of the Kashmir-Swat Neolithic pit phenomenon as the most likely explanation. However, the use of words such as 'presumably' and 'probably' (Allchin and Allchin 1982) or 'suggest' and 'tentatively' (Stacul 1994) indicate an openness to new interpretations.

The Pit Phenomenon of the British Iron Age

This South Asian phenomenon bears a close resemblance to that of the British Iron Age in terms of the size, shape and contents of the pits. Whilst it would be impossible and imprudent to draw formal analogies between the identification and interpretation across continents, it may be of benefit to apply the methods and theories which have been applied in reassessing the function of British Iron Age pits to South Asian Neolithic ones. Interpretations held by South Asian archaeologists are remarkably similar to those traditionally held for the British Iron Age — these similarities are even more striking when one considers that some of the earliest identifications of pit-dwellings in the latter can be attributed to Sir Mortimer Wheeler, one time Director-General of Archaeology in pre-Partition India! One of the most illustrative examples is furnished by Wheeler himself: at the Iron Age hillfort of Maiden Castle. He excavated a number of barrel-shaped or bell-shaped pits, varying in diameter between 1 m and 2 m, and in depth between 3.35 m and 0.6 m (Wheeler 1943). In many cases traces of postholes were identified on the margins suggesting to the excavator that they were furnished with a wooden super-structure or roof (Wheeler 1943), as suggested at Burzahom (Allchin and Allchin 1982). Wheeler attributed the function of some of the larger pits to stores, dining-rooms or living-quarters; for example, Pit B1 was interpreted as a dwelling as it had a central fireplace.

Since Wheeler's time advances in excavation techniques, improved recovery of organic remains and the increased use of ethnoarchaeological and experimental studies have allowed archaeologists to re-evaluate the function of such Iron Age pits. Many scholars now argue that the pits were used for the storage of grain (Fowler 1983; Reynolds 1974; Cunliffe and Poole 1991). It is notable, however, that as early as the 1930s Bersu was advocating such a hypothesis for the pits excavated at Little Woodbury in Wiltshire (Bersu 1938, 1940). An example of the benefits of modern excavation and the recovery of organic remains can be seen in the report on Danebury, an Iron Age hillfort in Hampshire (Cunliffe and Poole 1991). Although little organic material had actually survived, the presence of slumping within the fills of many pits indicated the rotting and subsequent compaction of layers of perishables — corn (Cunliffe and Poole 1991). Such evidence enabled the excavators to attribute a function of underground corn storage to most of the 645 pits excavated (Cunliffe and Poole 1991). A similar storage interpretation was reached by Reynolds through the use of ethnoarchaeological evidence from modern grain storage pits in the Chibi district of Zimbabwe (Reynolds 1974). More recently, experimental work carried out by Reynolds at the Butzer Ancient Farm Project attempted to replicate the living conditions within a typical 'pit-dwelling' of typical dimensions. This experiment demonstrated that as soon as a fire was lit in the base of the pit, the atmosphere became "completely intolerable due to the intense smoke produced in the reduced environment" (P.J. Reynolds: personal communication 1995). Thus it seems highly unlikely that such pits could have been occupied during winter months. The presence of fireplaces need not necessarily indicate domestic use. The firing of pits has been demonstrated to prolong the life of a pit considerably (Reynolds 1974) as well as having the advantage of clearing mould or dampness, or speeding up the drying process if plastering had been carried out. Moreover, if repeated and frequent fires had been lit within the pits one would expect their sides to have become impregnated with layers of soot - no such examples have been forthcoming from the Subcontinent. The functional advantages of the underground storage of grain are clear, as illustrated by Cunliffe and Poole (1991). Pits, once sealed, perform well as functional containers due to their reduced atmosphere but as soon the seal is broken the contents tend to rot rapidly. This factor has led to a hypothesis that the pits were used to store grain seed whilst grain for consumption was held in surface granaries. Furthermore the underground storage of grain seed would also protect it from destruction by raiders or chance catastrophe as no evidence of their location need be indicated above ground (Cunliffe and Poole 1991). Although there is still debate as to the pit's exact function, most scholars now refute the traditional interpretation of dwelling pits. Fowler, for example, states that "despite the unequivocal evidence...the British storage pit was for long accepted as the actual dwelling place of the Celtic farmer" (Fowler 1983: 182). In the light of the above discussion, the hypothesis that the function of many of the 'dwelling-pits' of the Kashmir-Swat Neolithic might also be re-assessed as grain stores should not be disregarded.

Towards a New Model

In order to test this new hypothesis, there are a number of associated methodological and theoretical problems which must be addressed. Evidently, fresh problem-oriented excavation is the most immediate need; until then, however, we are restricted to working with the available data.

The methodological questions include pit phasing, pit profile erosion, the differentiation of fills and the identification of organic remains. Undoubtedly the Swat valley examples provide the most accurate dating, but their dates cover 400 years (Stacul 1994) and there is no inter-pit phasing of this period provided. At Loebanr III, for example, we have no idea as to the contemporaneous nature of the pits, nor for how long they were open. Undoubtedly all were sealed by layer 3 but inter-period phasing is only suggested by the cutting of Pit 5 by Pit 2 (Stacul 1977: 230). This problem of the contemporaneousness of adjacent pits is also encountered whilst looking at the sections of the pits; the section of Pit 4 appears very clean and is bell-shaped suggesting an almost immediate filling, whilst the sections of Hut A, Pit 2 and Pit 5 appear to be very badly eroded (Stacul 1977). At the British site of Danebury, for example, some 60% of the excavated pits had suffered from some erosion which had significantly altered their upper profiles (Cunliffe and Poole 1991). Further confusion may arise from problems with the identification of taphonomic processes — it may be difficult to differentiate between an 'in situ' fireplace within a pit and a dump from a surface fireplace within the fill of a pit. There has also been a general absence of the recovery of organic remains from the pits. Further identifications, as of wheat and barley at Kalako-deray (Stacul 1993) and wheat, six row cultivated barley, common pea and lentil at Gufkral (Kajale 1991), combined with micromorphological analysis of pit fills and the recording of slumped sections during excavation would allow additional testing of the storage hypothesis. Although many of the pits may not contain macro carbonised remains, phytolith studies may contribute to a fuller representation.

The largest problem remaining is that even if one accepts a storage hypothesis, one still has to explain the placing of artefact assemblages within the pits. Undoubtedly in the Kashmir-Swat Neolithic some of the fills indicate a reuse as a refuse dump; however as at the British example of Danebury, a number appear to have gone through a series of decay and secondary use, often interspersed with periods of inactivity (Cunliffe and Poole 1991). Cunliffe and Poole have further suggested that "phases of activity may be defined as reflecting a deliberate act of deposition", often involving the placing of faunal remains or the deposition of single artefacts or artefact groups (Cunliffe and Poole: 161-2). They also advance the hypothesis that such deliberate depositions may be connected with rites associated with the storage of goods below the surface, and that their retrieval might necessitate some acts of propitiation. Such a model of deliberate deposition might also begin to explain the various fills of the Kashmir-Swat Neolithic pits previously identified as house floors. Certainly the assumption that the presence of floor-levels, fireplace remains, jars, vessels, miniature pots, stone tools and clay figurines indicate a dwelling-pit (Stacul 1994) must be reassessed as such finds were also recovered in 'storage pits' in the succeeding periods, VII and VIII, at Kalako-deray, when occupation is assumed to have been above ground. The upper fills of Pit A6, for example, yielded charcoal, 1 human terracotta figurine, 1 iron object and 2 stone, beehive-shaped spindle whorls (Stacul 1993). These later pits also suggest that size is not an indicator of whether a pit is a 'dwelling-pit' or a store. Period VII & VIII Pits A10 and B6 measured respectively 1.6 m in diameter and 1.25 m in depth and 2.7 m in diameter and 1.6 m in depth. Both were interpreted by the excavator as stores or mills (Stacul 1993), although similar features belonging to Period IV were interpreted as 'dwelling-pits' (Stacul 1994). Similarly, the deliberate placing of artefacts within a pit may signify the ending of that pit's role as a store and the beginning of a new role. Attempts to attribute a single function to a single archaeological feature have the danger of creating non-valid typologies or schemes of classification. A pit may therefore have as many changes in role or persona as a human may experience over a lifetime, although these may be non-functional roles of which we have no current understanding. Indeed, the general explanation, both functional or utilitarian and non-functional, of pit fills within the Subcontinent needs overhauling, as demonstrated in some of the Iron Age pit fills at the settlement site of Anuradhapura where human and animal remains have been recovered from 'refuse pits' (Coningham *et al.* in preparation).

If we accept that the pit features of the Kashmir-Swat Neolithic may have been grain stores, does this challenge our understanding of the culture complex as a whole? Two initial questions are raised, firstly, why have the inhabitants chosen to store grain below ground? We have already cited some of the functional advantages of underground grain storage, but there are numerous modern and archaeological examples of grain storage above ground in South Asia (Dhavalikar 1995; Khan 1995; Coningham 1995). Therefore, the choice of underground storage may have been associated with a particular over-riding factor. Scholars have always approached the Kashmir-Swat Neolithic as a sedentary culture as indicated by pit dwellings suitable for habitation throughout the year, including the very cold winters. If one now accepts that the pits were not inhabited but used for storage, one may hypothesise that a transhumant or semi-sedentary subsistence strategy is equally possible. In such a scenario the major nuclear sites could have been occupied and cultivated during the spring and summer seasons; following the harvest, grain seed would be deposited in underground storage pits which were then sealed in order to produce a reduced atmosphere which would prevent micro-organisms attacking the grain. With the onset of the winter season, the nuclear settlement could be abandoned for the less severe conditions of the plains or lower valleys leaving the underground grain stores, safe and unmarked on the surface, to be reopened in the next spring for sowing. Certainly this was the case with one of Reynold's pits at Little Butzer, when surface trampling caused it to be "temporarily lost" (Reynolds 1974). This paper's focus on grain production does not, of course, preclude the possibility that other forms of subsistence were practised at these sites. Indeed, the very presence of both wild and domesticated fauna (Stacul 1995) suggests a strong herding and hunting element, and similarly the gathering of wild flora cannot be excluded. Secondly, we must consider why we now have no evidence for habitation if all 'dwelling pits' are redesignated, unless dwellings were built over the pits as appears in the British Iron Age examples (Stacul 1995). Perhaps this absence may be explained by a transhumant or semi-sedentary way of life, as habitation would have had to be light-weight and mobile. Finally, it may be suggested that as we have advocated the rejection of the dwelling-pit hypothesis, we must begin to reassess the purported cultural links between the Kashmir-Swat Neolithic and those of Central and Eastern Asia as sub-surface storage is such a common cross-cultural phenomenon.

Despite substantial analysis and re-analysis of pit fills belonging to the British Iron Age, debate as to their function still continues (Cunliffe and Poole 1991; Hill 1995). Further study in both areas is necessary and the preliminary suggestions given in this paper do not, of course, preclude the evidence of pit-dwellers within the Subcontinent. In conclusion, we have presented a new hypothesis for the function of the Kashmir-Swat Neolithic pit phenomenon, building on substantial studies conducted on a similar pit phenomenon half-way across the world in a different millennium! However, we believe that it is this cross-fertilisation of ideas that will enable new interpretations to be proposed and tested, so that we may draw close to a fuller understanding of the past.

Acknowledgements

We are extremely grateful to Dr. Peter Reynolds of the Butzer Ancient Farm Project for his help and access to his unpublished experimental studies. We would also like to acknowledge the input of Dr. Bridget Allchin and Dr. Raymond Allchin of the Ancient India and Iran Trust, Cambridge and Professor Robin Dennell of the Department of Prehistory and Archaeology, University of Sheffield and to thank Dr. Chris Scarre of the McDonald Institute for Archaeological Research, University of Cambridge.

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Excavations at Balathal, Udaipur District, Rajasthan (1995-97), with Special Reference to Chalcolithic Architecture

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Introduction and Aims

The ancient site of Balathal (24° 43' N; 73° 59' E), discovered by V.N. Misra in 1964, is located on the eastern margin of Balathal village, 40 km east-north of Udaipur city and 6 km south of the town of Vallabhnagar in Udaipur District, Rajasthan (Misra 1967: 151). It is approached from Udaipur first by the Udaipur-Chittaurgarh highway and then, one km beyond Dabok airport, by a branch road. Balathal is one of the 90 odd Chalcolithic sites known in the Mewar region of Rajasthan, and one of the three so far excavated, the other two being Ahar within Udaipur city (Sankalia *et al.* 1969) and Gilund on the river Banas in Chittaurgarh District (*IAR* 1959-60: 41-46).

The original mound, with an oval shape, measured approximately 165 m (NE-SW) x 155 m (E-W) and covered an area of nearly 20,000 sq m or five acres. However, nearly two-thirds of it, along the periphery, has been partially or wholly destroyed by village farmers by converting it into agricultural land. Only at the centre is an area measuring about 90 m (N-S) x 80 m (E-W) and occupying nearly 5,600 sq m, still intact. This portion is common village land and is enclosed by a cactus fence. It is remarkably flat, with a gentle slope from north to south. The mound has a habitation deposit of seven metres (Fig. 1).

Systematic horizontal excavation at the site was begun in January 1994, jointly by the Department of Archaeology of the Deccan College Post-Graduate & Research Institute, Pune, and the Institute of Rajasthan Studies, Rajasthan Vidyapeeth, Udaipur, under the direction of Prof. V.N. Misra, Dr. Vasant Shinde and Dr. Lalit Pandey,[2] and so far four seasons of excavation have been completed. Before commencing the excavation the entire mound was gridded into 5 x 5 m trenches which were numbered with single or double English alphabets and Arabic numerals as seen in Figure 1. In the first two seasons an area of nearly 900 sq m was excavated in the southern part of the intact mound and the adjoining area to its south where the entire Early Historic deposit and a part of the Chalcolithic deposit had been removed by a farmer. The results of these excavations have already been briefly reported (Misra *et al.* 1995; Gogte 1996; Kajale 1996; Kshirsagar 1996; Thomas and Joglekar 1996; Misra 1997), and are summarized below.

The cultural sequence at the site consists of two periods, namely Chalcolithic and Early Historic, with a considerable stratigraphic and chronological gap between the two. The fifteen radiocarbon dates, available so far, suggest a duration of c. 2800-1500 B.C. for the Chalcolithic period and c. 200 B.C.-200 A.D. for the Early Historic period. The Chalcolithic culture is characterized by three residential complexes divided by a wide street and a narrow lane. The houses are made of stone and mud brick with mud walls and containing underground and above-

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[2] Fourteen members of the academic staff, nine members of the technical staff, six Ph.D. scholars and 20 M.A and M Phil students are taking part in the excavations The academic staff comprises an interdisciplinary team of archaeologists (Drs. V N. Misra, Vasant Shinde, R K Mohanty, Lalit Pandey and J S Kharakwal), archaeological chemists (Drs V D Gogte and Anupama Kshirsagar), archaeozoologists (Drs P.K Thomas, P P Joglekar and Arati Deshpande-Mukharjee), archaeobotanists (Drs. M D Kajale and B C Deotare) and ethnoarchaeologists (Drs. V N Misra, Malti Nagar and Ajay Dandekar). Drs Lalit Pandey and J S. Kharakwal, belong to the Institute of Rajasthan Studies, Udaipur, all the rest belong to the Deccan College

The technical staff includes one surveyor (Mr. B S. Waghmode), four draughtsmen (Mr. S A Pradhan, Mr R.D Rokade, Mr B B. Dighe, and Mr D V. Karanjkar), one artist-modeller (Mr V G Vishwasrao), and two photographers (Mr. Sunil Jadhav and Mr. Ravi Dhamapurkar) Ph.D scholars comprise Mr Kurush Dalal, Mr Anup Mishra, Mr. Balaram Tripathy, Mr Abhijit Dandekar, Ms. Rhea Mitra and Ms Tama Panda They as well as M A and M.Phil students of the Deccan College and Diploma students of the Rajasthan Vidyapeeth assist in the supervision of excavation. In addition, about 100 men and women from Balathal and the nearby villages are employed for digging operations.

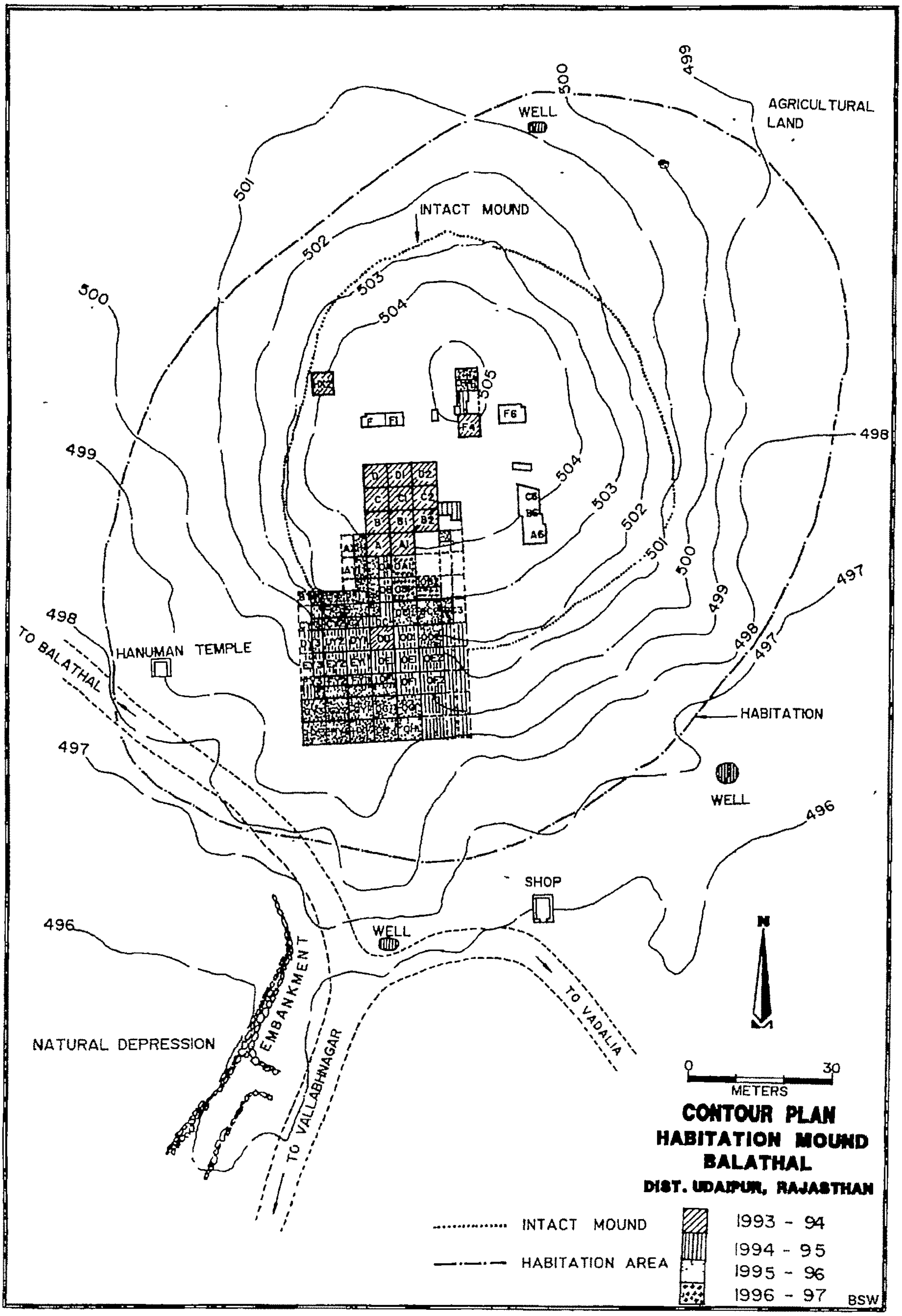


Fig. 1: Contour plan of the Balathal mound showing trenches excavated from 1994-97

ground silos, hearths and fireplaces, and numerous intact and broken saddle querns. A fortified enclosure in the centre of the settlement is made of massive mud and stone walls revetted on both faces with stones and with bastions at the corners. The cultural material comprises copper and stone blade technology; Black-and-Red Ware, Tan Ware, Thin Red Ware, Thick Red-slipped Ware, Grey Ware, Buff Ware, and Reserved Slip Ware; terracotta and semi-precious stone beads and terracotta animal figurines. The economy was based on the cultivation of wheat, barley and mustard, and in addition to the domestication of cattle, buffalo as well as sheep and goat, the inhabitants also practised hunting and fishing. The incipient settlement planning, fortification, and Tan Ware show a distinct influence of the Harappan culture of Gujarat.

The Early Historic occupation was restricted to a small area in the southern part of the mound. It is characterized by large-scale iron smelting and the manufacture of iron objects; small wattle-and-daub houses with open terracotta pipe drains; plain red and grey ceramics; a few heavily weathered copper coins; semi-precious stone and terracotta beads; terracotta animal and human figurines and sealings; and one example of a ring well. Large quantities of bones, mainly of domesticated animals, and of charred grains of *urd* and *moong* provide evidence of the subsistence economy.

Further excavations at the site were carried out in two seasons — 1995-96 and 1996-97, during which, besides the area dug earlier, an additional area of 600 sq m was excavated. The main objectives of these excavations were:

1. to further expose the partially dug structure 10A-F of complex 1, and structure 11 of complex 3, with a view to reconstructing the settlement pattern and socio-economic organization of the Chalcolithic settlement;
2 to determine the cultural affiliation, age and function of the fortified enclosure (structure 4); and
3. to define the role of iron smelting and manufacturing activities at the site in the Early Historic period of northwest India.

Excavation Area

Trenches OA1, OB1, OD2, the southern half of OB2, OC1, OC2, and the western half of OC3 were dug to further expose structure 10A-10F of the Chalcolithic structural complex 1 (partially exposed in the previous seasons). The western wall of this complex was seen extending towards the north. To find out its northern limit and its relationship with the fortified enclosure located in the central part of the habitation, trenches A, OA, OB, the northern half of OC and the eastern half of AX1, AY1 and BY1 were excavated.

In addition, the northern half of trenches CY1, CY2, the northeastern quadrant of CY3, the southern half of BY2, the southwest quadrant of BY1 and the southeast quadrant of BY3 were opened to fully uncover the pottery kiln noticed in the 1994-95 season. On the southern side of the northern wall of Structure 11, partially exposed in the previous season, a number of trenches comprising OG, OG1, GY1, GY2, GY3, OH, OH1, HY1, HY2, HY3, the southern half of OF, FY1, FY2 and the southeastern quadrant of FY3 were excavated, as a result structural complex 3 was almost fully uncovered. The northwestern quadrant of trench A3 was dug to trace the extension of the north-south projection of the outer side of the southern wall of the fortified enclosure. Trench H4, located immediately to the north of the northern wall of the fortified enclosure, and the western half of B1 were excavated to understand the stratigraphical and chronological position of the enclosure. Thus the total area excavated during these two seasons was about 700 sq m (Fig. 1).

Stratigraphy (Fig. 2)

In the first season (1993-94) two disconnected areas were chosen for excavation: one in the central part of the intact mound, and the other in the southern part of the mound where the upper deposit comprising Early Historic material and, in some trenches, the top layers of the Chalcolithic period had been removed by a local farmer. The latter area was selected because here the Chalcolithic structures and other remains, which were our main interest, could be uncovered right beneath the surface. In the intact portion of the mound, Trench F4 (located on the highest part) was chosen as the index trench for determining the stratigraphy and cultural sequence of the site, and it was dug down very close to the virgin soil. The stratigraphy of the other trenches was correlated with that of the index trench and antiquities found in the excavation were marked accordingly. Six other trenches — B, B1, B2, C, C1, C2, D, D1 and D2 — were also selected for excavation on the intact portion of mound to the southwest of F4. In the first season digging in these trenches was confined to the Early Historic period deposit. After the fortified enclosure was discovered, it was noticed that all these trenches were located inside it.

In all these trenches the first three layers, though variable in thickness, belonged to the Early Historic period Layer (4), 20-25 cm thick, was composed of compressed white ash and was remarkably horizontal both at its base and at the top. While this layer was present in all the trenches inside the fortified enclosure, it was discontinuous and slowly thinned out and eventually disappeared south of the enclosure. This layer was devoid of any cultural material.

Layers (5) to (12) in trench F4 were mainly composed of burnt cow dung and vitrified ash and sloped from north to south. Layers of similar composition, though less conspicuous and interspersed with layers of heavily burnt

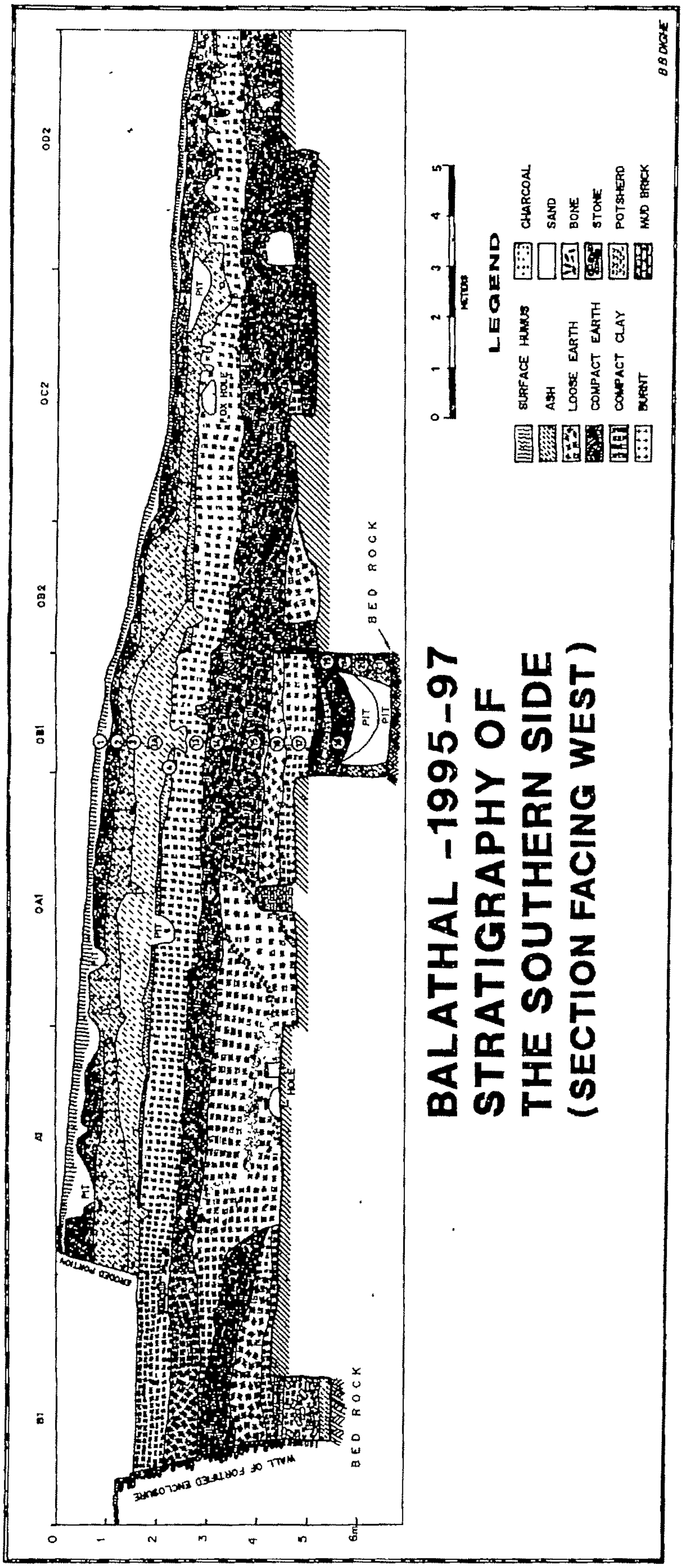


Fig. 2: Stratigraphy to the south of the fortified enclosure (section facing west)

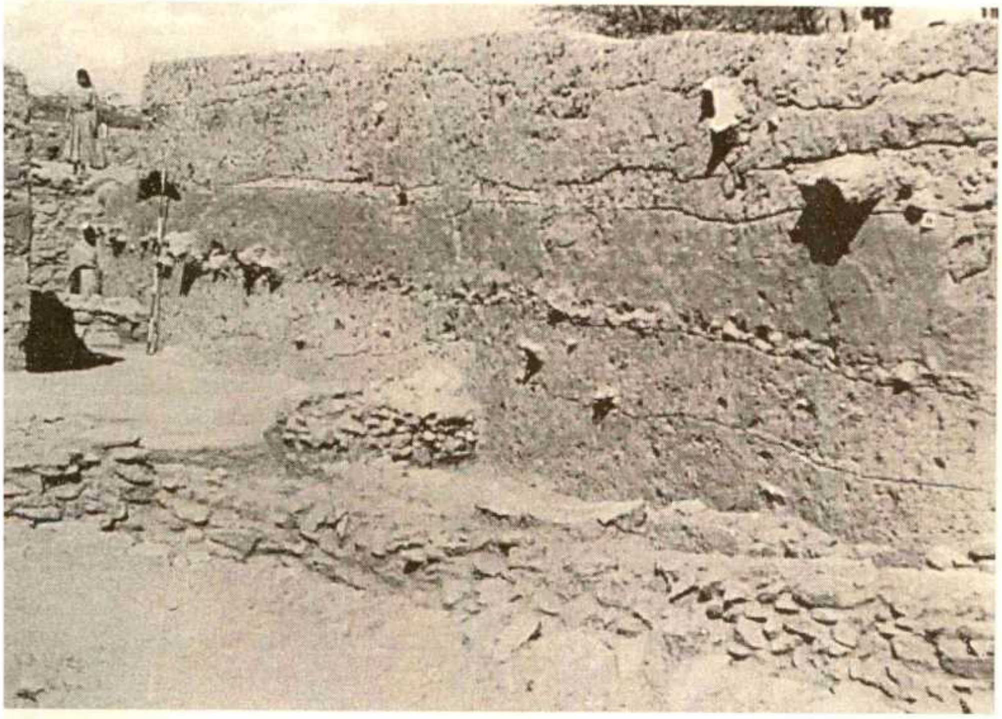
reddish earth, occurred in trench D2 inside the fortified enclosure to the southwest of trench F4. Layer (13) in trench F4 was 30-40 cm thick and consisted of dark grey earth and was largely devoid of cultural material.

In the trenches in the residential area in the southern part of the mound, where the upper deposit had been dug away by a farmer, the topmost surviving layer was identical in composition to the dark grey layer (13) of index rench F4 and was therefore numbered 13. Accordingly, ayers below it were numbered 14 onwards. However, when digging was done in the second season in other renches in the intact part of the mound, between the fortified enclosure and partially destroyed mound further south, it was found that layers (5) to (12), noticed in the ndex trench F4, were totally absent here and that layer (5) n these trenches was equivalent to layer (13) of the index rench.

However, by this time layers below the Early Historic deposit in the trenches in the partially destroyed southern part of the mound had already been numbered from 13 onwards and antiquities found in them marked accordingly. t was therefore decided that layer (5) of the trenches in the ntact part of the mound should also be numbered (13) and ayers below it numbered from 14 onwards. Changing the numbering of layers at this stage would have required hanging the markings on several thousand potsherds and other objects which was both time-consuming and impractical. Thus, outside the fortified enclosure, the layers are numbered from 1 to 4 and below them from 13 onwards. Because of this conscious pragmatic decision, even though the recorded number of layers in most trenches is 21 or 22, the actual number is only 14 or 15.

Explanation for discrepancy between the stratigraphy of trench F4 and other trenches

The fortified enclosure seems to have ceased to be used for the purpose for which it was constructed before the end of the Chalcolithic period. The abandoned enclosed space was subsequently used for storing cow dung which may have been used as fuel for smelting copper, baking earthen pots and cooking. The use of cow dung for firing pots is seen in both the pottery kilns found on the western side of structural complex 2. In all probability the cow dung was stored by the people living on top of layer (6) of the index trench because in burnt form it is sealed by layer (5). The stratigraphy of trenches F4 and D2 clearly shows that the cow dung was thrown from the walls of the fortified structure as the deposit slopes towards the central part of the enclosure. It is not clear whether the cow dung was burnt intentionally or by accident. Along the inner side of the northern wall of the fortified structure the deposit of burnt cow dung is about 2.30 m thick. Here the cow dung appears to have been dumped as one episode as we do not see any stratification in the deposit. But the cow dung along the inner side of the southern wall of the fortified structure appears to have been dumped in phases as several layers (6-10) were formed by this activity.



ig. 3: Section along the western face of trenches B1, A1, OA1, OB1, OB2, OC2 and OD2. The dark grey layer (13, with a stone bedding at its base, is the sterile layer between the Chalcolithic and Early Historic deposits

However, since there is no evidence of cow dung and ash deposit in the trenches outside the fortified enclosure, layers 5 to 12 are absent in them.

Nature of Layer 13/5 (Fig. 3)

This layer is dark grey in colour, compact and homogeneous and there is a 10-30 cm thick bedding of angular stones at the base. Its maximum thickness of 1.0 m occurs in trench A. To the south of trench A the thickness of both the total layer as well as of the basal stone bedding becomes progressively less, and finally the layer disappears beyond trench OF. The layer is totally absent in the northern part of the mound where the Chalcolithic deposit and the surface of the fortification wall extend almost to the top of the mound. It is present only in the southern and eastern parts of the mound to the south of trench G4 which represents the northern limit of the fortification. The layer is devoid of evidence of regular human occupation, except for the presence of occasional potsherds and animal bones. However, in its lower part the potsherds belong only to the Chalcolithic period while in the upper part sherds of Early Historic pottery are also present.

When this layer was discovered in 1995, we had considered several possibilities for its formation. These were: (1) natural deposition after the abandonment of the site by the Chalcolithic people; (2) erosion of the assumed mud deposit over the stone, mud brick and mud walls of the fortified enclosure; and (3) intentional levelling of the uneven surface of the Chalcolithic period by the Early Historic people. The weight of available evidence now suggests that the layer was intentionally formed. Since the site remained unoccupied for nearly 1500 years after its desertion by the Chalcolithic people, the stones belonging to Chalcolithic structures, particularly the southern wall of the fortified enclosure, were probably moved down the slope of the mound by rain water and gravity. This is indicated by the progressive reduction in the density and size of the stones from north to south. These stones form the base of layer 13. The dark grey silt overlying the stones was probably brought by the Early Historic people from fields surrounding the site to level the uneven ground for their habitation.

Structures (Figs. 4-5)

The structures uncovered in the Chalcolithic levels can be divided into two categories: (1) fortified enclosure and (2) residential structures. Two phases of structural activity can be identified. In Phase I the structures are small and modest and consist of circular huts made of wattle-and-daub. Their floors were made of rammed earth and plastered with mud mixed with straw and sometimes also with lime. The presence of post-holes around the periphery of the floors and of burnt pieces of clay plaster suggests that the superstructure consisted of round wattle huts plastered with clay. Phase II structures are large and complex and show a marked change in building materials and techniques.

Construction Materials and Techniques

Stone, mud brick and mud were the principal materials employed in the construction of most of the structures of Phase II. The foundations were made of stone, and the walls of stone, mud brick and mud. The roof was probably made of wooden beams and rafters, capped by mud in the case of structures with massive stone walls, and of thatch in the case of small structures of wooden posts and mud brick and mud walls. The stones were laid one above the other in a perfectly straight alignment and were joined together by mud mortar. The stone walls of some residential structures have become inclined towards one side, probably due to their weak foundations and the weight of the upper mud brick and mud walls and collapsed debris. The presence of burnt pieces of mud plaster in the excavated debris and the analogy of local rural houses suggest that the walls were plastered with clay and cow dung.

Locally available granite and gneiss rocks were used for construction. The average size of the stone blocks and slabs is 25 cm long, 15-20 cm wide, and 10-15 cm thick, though in some cases considerably bigger pieces were used. Since stones are not available loose in the area, they had to be quarried from the living rock as is the practice today. Further, since copper tools were too small and fragile for quarrying stone blocks, they were most probably detached from the living rock by heating it with fire and then creating cracks in it by pouring water over it. Stone hammers and copper and wooden wedges may have been used to loosen the blocks which were then minimally dressed except for straightening of the sides in some cases. The use of dressed stones is particularly noticeable in the case of the exposed eastern corner of the southwestern bastion of the fortified enclosure.

Fortified Enclosure

The most remarkable discovery at Balathal is a fortified enclosure located in the central part of the mound. During the first two excavation seasons only the surface outline of this structure was exposed in several trenches and the inner face of the stone revetment of a part of the northern wall was exposed in Trench F4. The structure was roughly rectangular in shape though its eastern wall deviated outward and extended about eight metres beyond the outer limit of the southern wall. The average length of the E-W walls is 35 m and of the N-S walls 27 m. The width of the walls on the surface is 4.80 to 5.0 m. The walls appeared to be made of mud and revetted with stones on the inner as well as outer side. The structure enclosed an area of over 500 sq m. In our first publication on the excavation this structure was designated as a mud rampart with stone

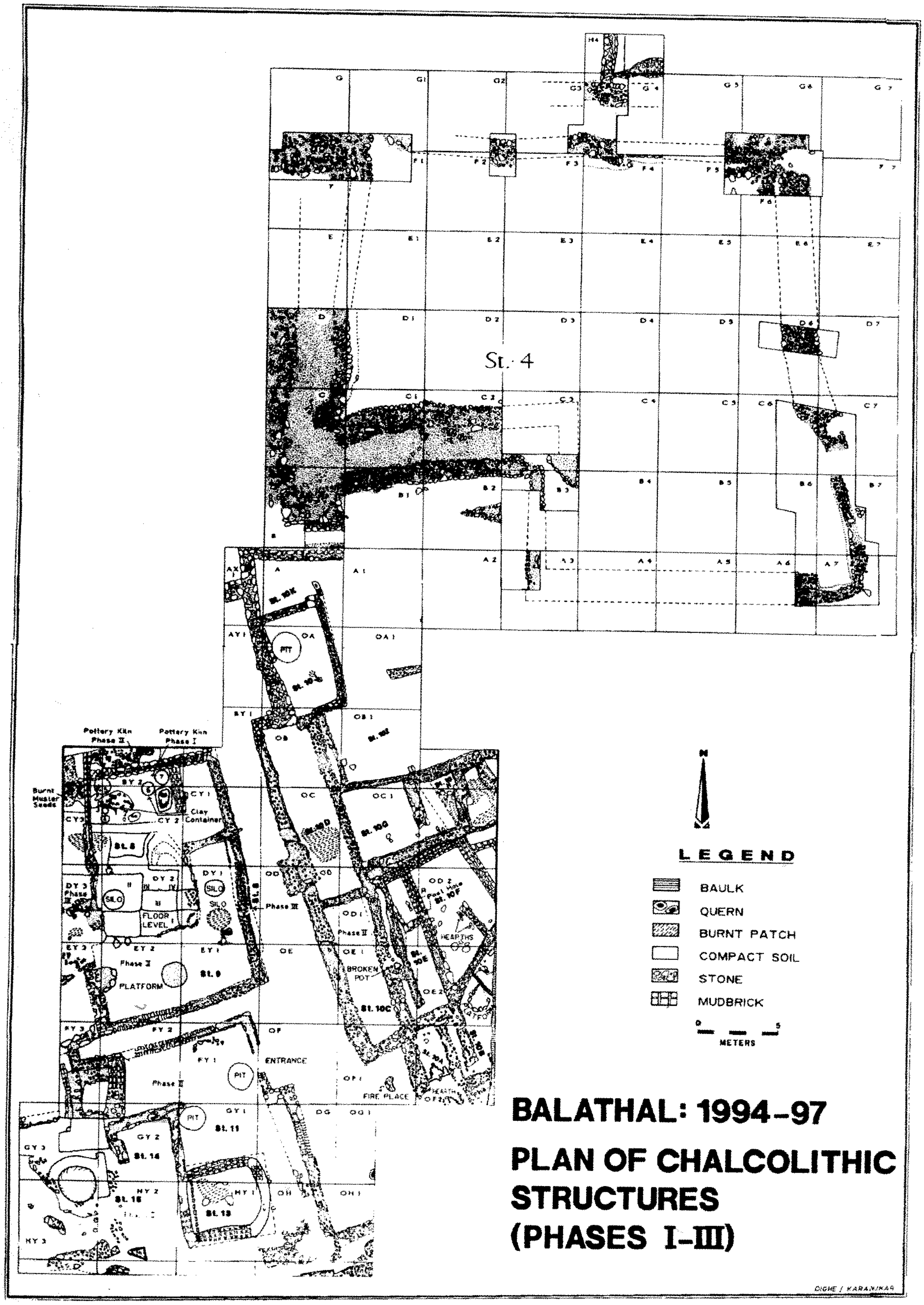


Fig. 4: Plan of Chalcolithic structures (Phases I-III), with residential complexes (1-3) in the foreground and fortified enclosure (structure 4) in the background

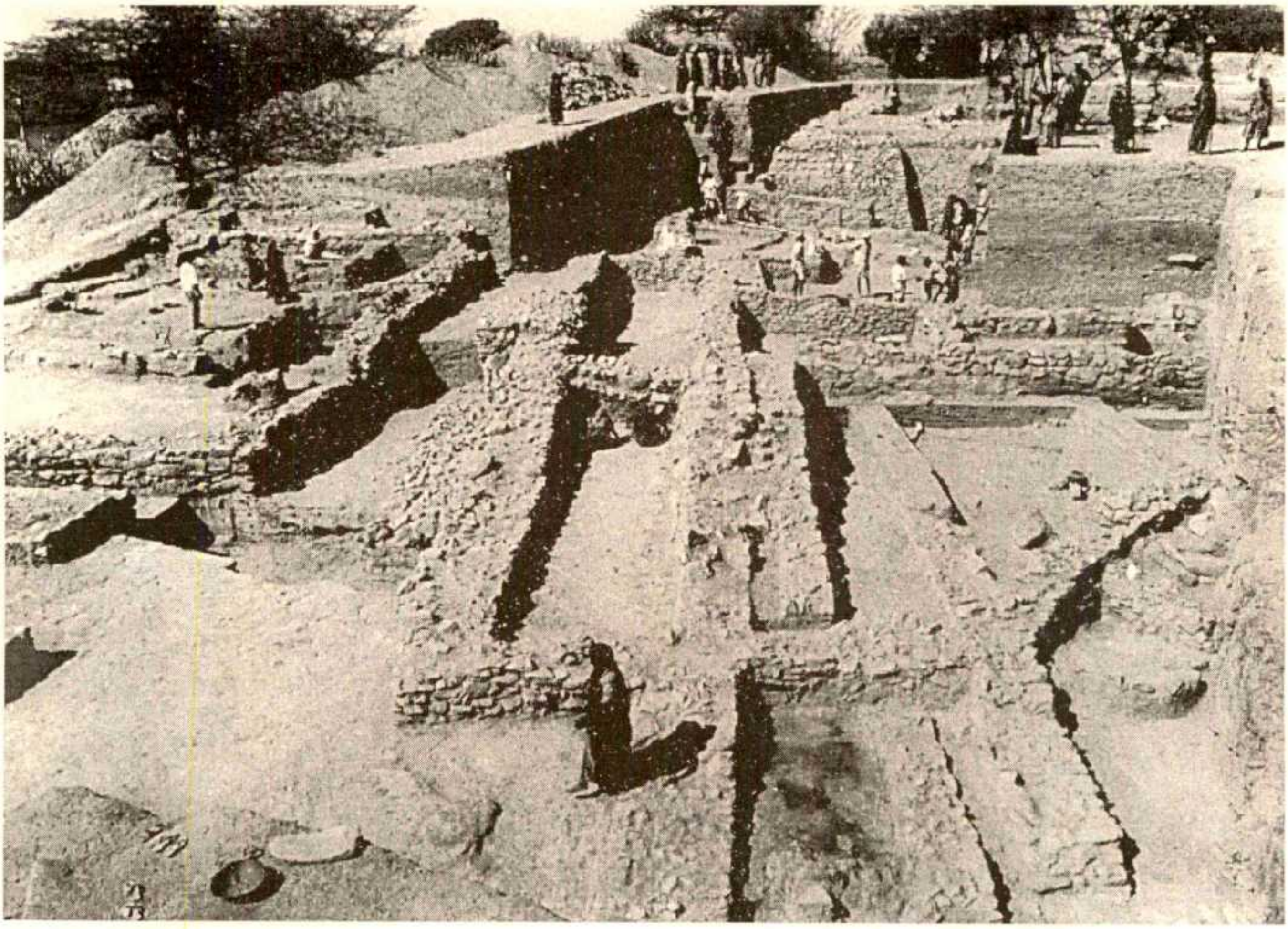


Fig. 5: Chalcolithic structures, with residential complexes 1 and 2 in the foreground, and a part of the southern wall and southwestern bastion of the fortified structure in the background

revetments and was assigned to the early Iron Age (5th-6th century B.C.) (Misra *et al.* 1995). This dating was proposed on the following grounds:

a) The structure was buried beneath layer 4 which consisted of compact white ash and was sterile. This ash was thought to have been produced by the burning of a wooden superstructure which might have stood over the mud and stone walls. Layers 1-3 had produced Early Historic material, including iron smelting furnaces and slag, a large number of iron tools, pottery, glass bangles, a ring well and a few copper coins.

b) The stratigraphy of Trench F4, inside the enclosure, was highly confused due to the dumping of cow dung and the presence of heavily vitrified ash inside it. Pieces of Early Historic pottery occurred in this ashy deposit down to layer (12).

However, we had strong reservations about the cultural affiliation and date of the structure and, therefore, to resolve our doubts we decided to carry out digging contiguous to the outer walls of the structure as well as inside the structure. With this aim in mind we excavated trench H4 outside the northern wall, trench B1 outside the southern wall, a deep pit in trench D in the western wall, and trench D2 inside the enclosure.

The results have established beyond doubt that the fortified enclosure belongs to the Chalcolithic period. They further show that the structure was built during the middle phase of the Chalcolithic occupation and continued to be in use up to the end of the Chalcolithic period.

Trench H4 (Fig. 6)

Trench H4 was dug in its southern half to a depth of 4.65 m. The stratigraphy of the trench revealed that the top 13 layers rested directly against the standing wall of the enclosure, clearly showing that they were formed after the construction of the wall. Only the first three layers be-

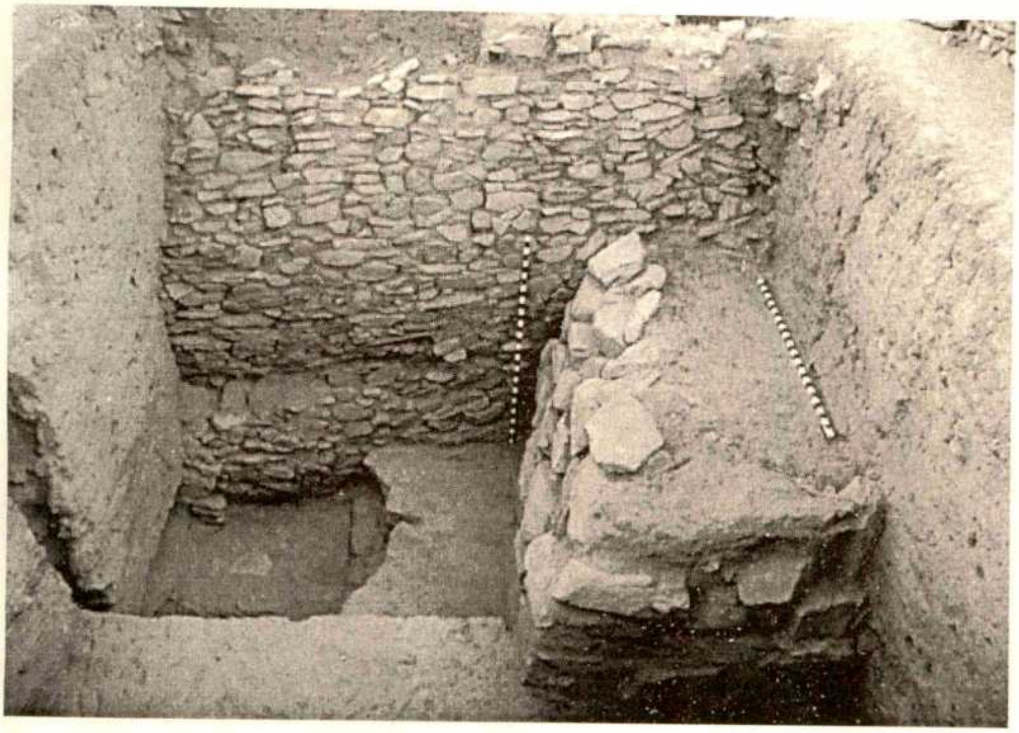


Fig. 6: Outer face of the northern wall of the fortified enclosure and the supporting stone wall in trench H4

longed to the Early Historic period whereas the remaining ones belonged to the Chalcolithic period.

The outer face of the northern wall was exposed down to its base. The wall here has a height of 4.15 m. It is made of small flattish stones, with an average size of 20 x 15 cm, of locally available granite, and set in mud mortar. At regular intervals a course of relatively larger stones (45 x 15 cm) was added to the wall, obviously to strengthen it and prevent it from collapsing. Forty-five stone courses of the wall have survived. That the wall was weakening with the passage of time is indicated by the bulging in its central part. The bulging starts at 1.20 m from the top and continues for downward 1.60 m. The presence of pieces of thick clay plaster on the wall suggests that it was plastered with clay. The wall appears to have been repaired at least twice. The first phase of repair occurs at a height of 1.20 m and the second at a height of 3.70 m from the base.

Further evidence of strengthening the wall is provided by the presence of a 2.70 m long, strong and N-S oriented wall which is joined to the main wall in the southwest quadrant of trench H4. It is made of mud bricks and stands over a massive foundation of six courses of large stones (average size 60 x 35 cm) set in mud mortar. The wall has a height and exposed width of 1.80 m each. However, its exact width cannot be determined as it extends into the undug western section. The mud brick portion of the wall has survived to a height of 75 cm. The wall slightly broadens towards its base. This side wall as well as the wall of the enclosure stand on a common mud and mud brick platform. This feature as well as the common technique employed in their construction suggest that both of them were built simultaneously.

Trench B1

Digging was done in the southeastern quadrant of trench B, adjacent to the bastion, and in the southwest quadrant of trench B1, to a depth of 4.10 m, to expose the total height of the southern wall of the enclosure and the bastion, and to study the deposit resting against them. The height of the wall is 3.21 m and that of the bastion is 3.37 m. Two phases of construction are visible. The first phase (2.85 m high) in its lower 1.40 m portion runs almost vertical down to the base. Above the lower portion, the wall bulges 1.36 m outward. The basal course of the wall is made of stones (average size 30 x 20 cm), and it rests on a mud and mud brick platform, 70 cm thick. The second phase is represented by a surviving height of 36 cm. To strengthen this upper portion, a 1.50 m broad support wall was raised on the outer side. It is made of black clay and rests on a stone foundation. The outer face of the wall as well as the bastion broaden towards their bases. The bastion bulges 1.10 m outward at a depth of 2.20 m from the surface. The support wall was partially removed to study the lower stratigraphy of the fortification. It was observed that the outer face of the wall and the bastion were both constructed on top of layer (17) which represents the middle phase of the Chalcolithic period. Like the enclosure wall in trench H4, both these architectural features stand on a 70 cm thick, strong platform of which the lower 45 cms is made of mud, mud brick bats and stone packing whereas the upper 25 cm is made up of two mud brick courses. The mud bricks are laid horizontally and are set in lime mortar. The full width of the platform is not clear as it continues on the southern side beneath the undug habitational deposit. It appears likely that some habitational deposit was removed prior to building the base of the wall. The fortified enclosure resembles the construction method followed by the Harappans (Fig. 7).

Trench D

With a view to understanding the construction process of the fortification, a part of the core of the western wall, between the outer and inner revetments, was dug down to its base in the northeastern quadrant of trench D. The wall here has a height of 3.80 m and is made of a mixture of mud, complete and broken mud bricks, and occasional stones, all of which were rammed hard. This portion of the wall has a width of 2.20 m. It is supported on both sides by 1.60 m wide stone revetments, thus raising the total width of the wall to 5.40 m. The inner mud and mud brick core as well as the stone revetments were constructed on top of layer (15) which is made of pinkish clay and appears to have been intentionally laid to strengthen the foundation (Fig. 8).

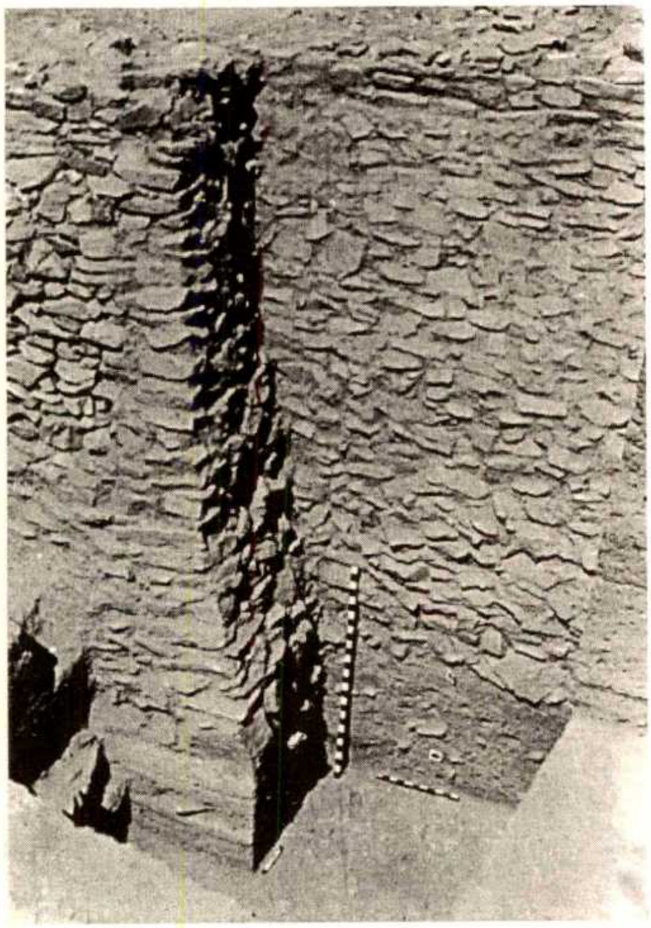


Fig. 7: Close-up of a part of the southern wall and of the southwestern bastion of the fortified structure in trench B. Use of semi-dressed stones in the corner of the bastion is clearly seen

Trench D2

Digging was done to a depth of 7.15 m in this trench to get an insight into the activities carried out inside the fortified enclosure. This proved quite fruitful as it provided an almost complete temporal history of the enclosure. Layers (6) to (9) are composed of burnt cow dung and heavily burnt earth and rest on the last occupational level (layer 10) of the enclosure. Beneath this level there is a 2.0 m thick deposit formed of floor levels and floor beddings. For this reason the nature of stratification here is different from that outside the enclosure. At least three major occupational levels, represented by layers (14), (12) and (10) were detected, suggesting that the structure was occupied for a fairly long time, from the middle to the terminal phase of the Chalcolithic period. The average thickness of the floors is 15 cm and each of them is made of a thick layer of fine sand and silt rammed hard and plastered with lime and cow dung.

Each floor rests on a bedding of an intentionally laid thick layer of blackish clay mixed with sporadic stones and brick-bats. Layers (13) and (11) represent such beddings. This bedding was probably provided for levelling the floor after it became uneven due to constant occupation and use. These floor levels, however, do not provide any clue to the function of the fortified enclosure.

Layer 15 consists of a bedding of homogenous clay which appears to have been intentionally laid as the foundation for the fortification wall. Layers 16 to 21 are regular habitation deposits. Pieces of burnt clods of earth mixed with grass and bearing reed impressions suggest wattle-and-daub houses in this stage. In the southeastern corner of the trench in the very first occupation layer two U-shaped ovens (*chulhas*) with a common central arm were found raised right over the bed rock. They are uniform in shape and size with a width of 35 cm and a height of 20 cm. The presence of these ovens and living floors right on the bed rock, seen in conjunction with the evidence from HX2, shows that the pioneering settlers occupied the central as well as the western part of the mound and that the fortification was raised over the habitation deposit (Fig. 9).

Residential Structures (Figs. 4-5, 10)

Besides the fortified structure, the excavations have brought to light a number of Chalcolithic residential

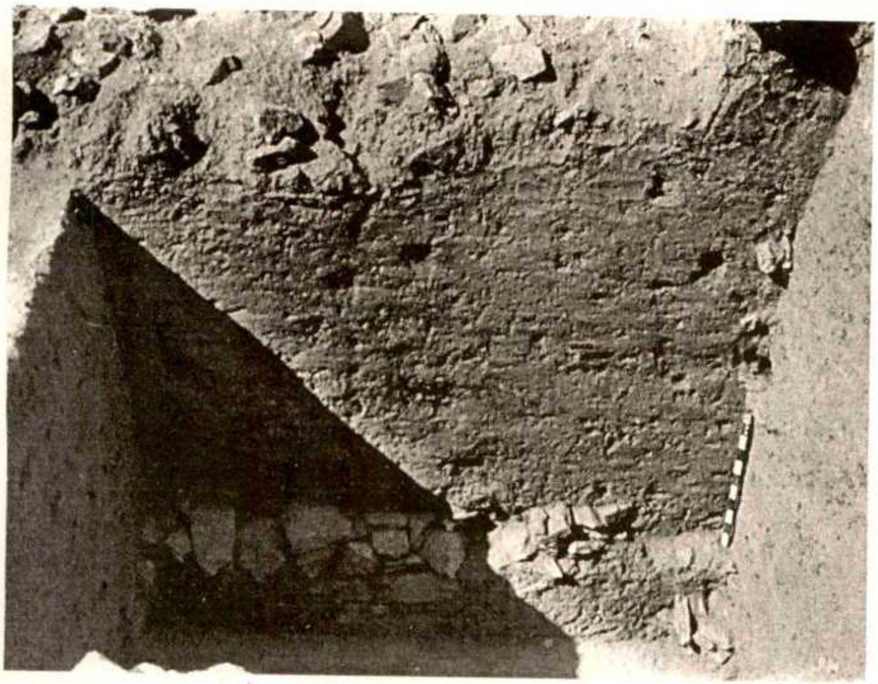


Fig. 8: Composition of the core of the wall of the fortified enclosure, between stone revetments on both sides, as seen in the deep pit dug though the western wall in trench D

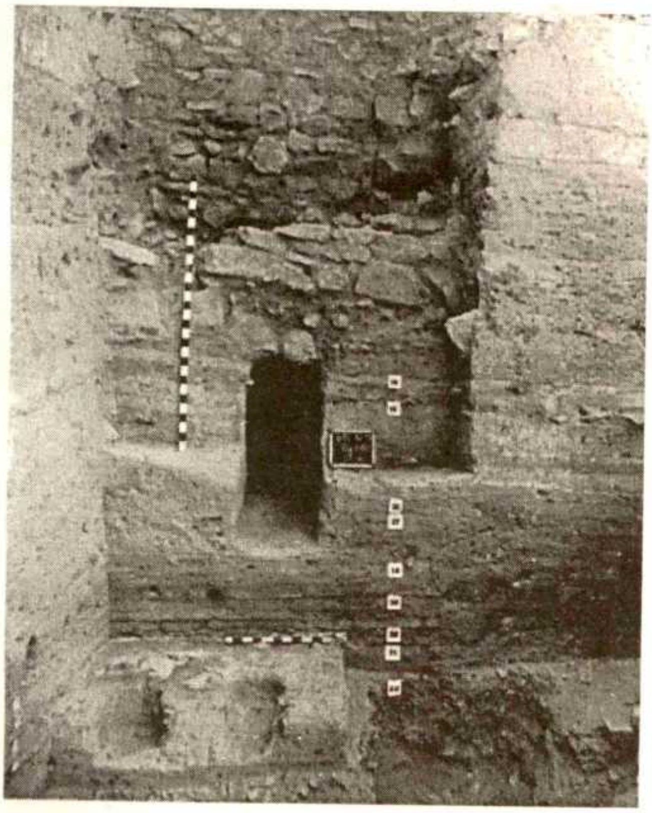


Fig. 9: Inner face of the southern wall of the fortified enclosure in trench D2. The vertical tunnel, seen at the base of the wall, was dug to trace the foundation of the wall, without endangering its stability. Also seen are two ovens (*chulhas*) resting on the bed rock and antedating the construction of the fortified enclosure

structures in the southern part of the mound. Four structural phases were identified at the site during the first two seasons of excavation (Misra *et al.* 1995). While there has been no addition to the structures of Phase I during the excavations in the last two years (1995-96 and 1996-97), more structures of Phases II-IV have been discovered. Phase II, which witnessed a spurt of structural activity, is represented by three large complexes. Phase III is represented by three single or double-roomed dwelling structures and Phase IV is represented by two modest structures. In the northern part of the site a few mud brick structures were partially exposed in the upper levels of trench H4.

Phase II

Structural Phase II, contemporary with the fortified enclosure, was the most prosperous phase at the site. The sudden increase in the prosperity of the settlement around 2400 B.C. may be attributed to the contact established between the Balathal people and the Harappan people of Gujarat. This contact led to the incipient planning of the settlement, with structures located along the sides of a wide street and a narrow lane.

One major street, oriented roughly northwest-southeast, was exposed near the southwestern corner of the fortified enclosure. The street is exposed to a length of 37 m and its width varies from 2.70 m at the northern, to 2.0 m in the centre and 4.80 m at the southern end. To the east, west and southwest of this street three structural

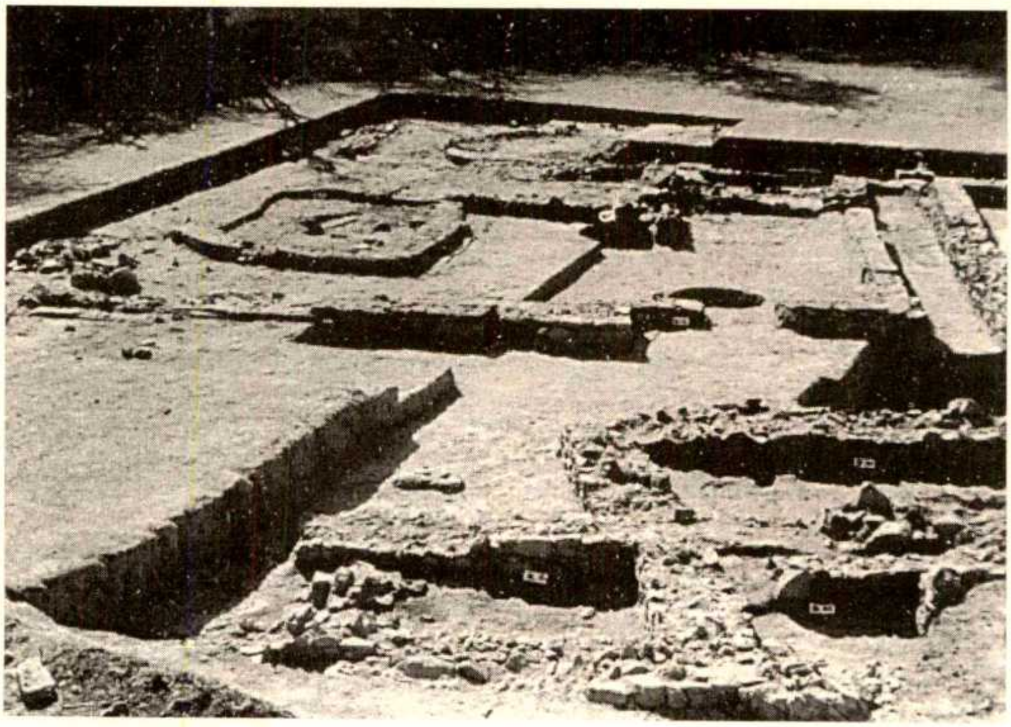


Fig. 10: Residential complex 3 (in the background) and a part of complex 1 (in the foreground)

complexes have been partially exposed (Fig. 4). All the structures of this phase are sealed by layer (16).

Structure Complex 1 (Rooms 10A-10K)

Among the three complexes exposed so far, this is the largest one. It is located immediately on the eastern side of the street and runs parallel to it. The complex consists of a number of rectangular and squarish rooms of varied dimensions. So far eleven rooms have been exposed and some more are likely to be exposed as the complex extends into the northern and eastern sections. Structures 10A, 10B and 10C were fully exposed earlier. The first one was identified as a kitchen and the other two as storage rooms (Misra *et al.* 1995). Structure 10D, 10E and 10F, which were partially dug in the previous seasons, have been fully exposed. Besides these, five more rooms (Structure 10H to 10K) were exposed during the last two seasons.

Room 10D

This room, located on the northern side of Room 10C and partially exposed earlier, is rectangular and narrow on plan, measuring 11.40 m along the western wall and 10.50 m along the eastern wall. The longer axis of the room is roughly in the northwest-southeast direction. The room tapers slightly towards the southern side, the width of the northern half being 2.83 m and that of the southern half 2.55 m.

The northern wall of room 10C, 4.30 m long, forms the southern wall of this room. Room 10D is more or less identical in shape with room 10C. This may also have functioned as a storage area as there is no evidence of domestic or any other industrial activity inside. This long and narrow chamber is not suitable for dwelling purposes either.

Room 10E

This room, partially exposed in the 1994-95 season, has been completely exposed now. It is a narrow, long rectangular chamber, roughly oriented in a northwest-southeast direction. It is 8.40 m long (N-S) and 2.40 m broad (E-W). The eastern wall of room 10C forms the western wall of this room and the northern wall of room 10A forms its southern wall. The eastern wall of this room is 9.40 m long, 65 cm wide and has survived for a height of 50 cm. The northern wall has survived for a length of only 1 m; the remaining portion has been destroyed by the support wall raised against the eastern wall of room 10C. The width of the northern wall cannot be determined as it partially underlies a later wall of the same complex. The function of this room cannot be determined as its major portion is hidden beneath the support wall raised slightly later. This room may have fallen into disuse after the raising of the support wall.

Room 10F

This room was also partially exposed in the previous season but its entire plan has become clear now. It is located on the eastern side of room 10E. It is roughly rectangular in shape but the eastern side is shorter than the western one, making the southwestern corner roughly triangular. The southern wall first runs in an E-W direction for a length of 6.90 m and then is oriented in a northeast-southwest direction. The length of the western wall is 7.75 m and that of the eastern wall is 4.70 m. The width of the room along the northern wall is 3.60 m but it increases to 4.50 m along the southern wall. The eastern wall of room 10E forms the western wall of this room and its northern wall, which is 60 cm broad and has survived to a height of 40 cm, is a continuation of the northern wall of room 10E. While the other walls are made of stones, the eastern wall is made of bricks over a stone foundation.

This room appears to be a kitchen as it contains two domestic hearths near the southern wall. They are very close to a mud wall which is 2.40 m long and 45 cm wide and runs in a roughly northwest-southeast direction. This small wall may have been erected to demarcate the kitchen area. The hearth located on the northern side is intact while the other is partially disturbed. The intact hearth is represented by three vertical stones placed in a circular outline with a diameter of 20 cm and is located 2 m east of the western wall and 2.30 m north of the southern wall of the room. Its sides and the base are burnt red suggesting its constant use over a longish period. The second hearth lies 10 cm to the south of the first one. It is triangular in shape but one of its stones is missing.

A number of cattle bones showing traces of charring and cooking were found lying on the floor close to the hearths. The presence of large pieces of a jar of Thick Red-Slipped Ware near the bones supports the hypothesis that this room was a kitchen.

Room 10G

It is a squarish room located on the northern side of rooms 10E and 10F and on the eastern side of the southern part of room 10D. Its western wall is formed by the southern portion of the eastern wall of room 10D. It is 4.80 m long and 60 cm broad. The northern wall is 4.0 m long and 40 cm broad and has survived to a height of 95 cm. It is perfectly vertical and is made of relatively small stones set in mud mortar. Traces of plaster suggest that the entire wall was originally plastered with mud. The eastern wall, which is 60 cm thick, is slightly inclined towards the west. It is 3.20 m long and has survived to a height of 80 cm. It is made of relatively large stones. A 50 cm opening in this wall towards the southern side probably represents an entrance to room 10H. The area enclosed by this room is 4 m (E-W) x 3.90 m (N-S). The floor of this room is carefully made and, therefore, the room may be interpreted as a dwelling room of the complex.

Room 10H

This room is located on the eastern side of room 10G with which it shares a common wall. Its northern and southern walls are unequal in length, the former being 3.80 m and the latter 4.40 m. Its eastern wall is oriented northwest-southeast, making the southern part of the room slightly wider than the northern. This wall is exposed to a total length of 2.30 m, its southern end extending into the undug section. Its average width is 75 cm. The stone foundation of this wall has survived to a height of 70 cm near its northern end and traces of a mud wall above the foundation are visible near the northern end.

This room is likely to have been used for storage as it contained two roughly circular clay bins, and was probably destroyed by fire as indicated by the presence of burnt remains of clay plaster. The collapse of the roof may have damaged the clay bins, one of which located on the western side, almost in the northwestern corner of the room, is comparatively small in size. Only its basal portion has survived. From the remains it is clear that it was circular on plan, with a diameter of 55 cm. Only the lower 15 cm portion has survived. The other clay bin which is 35 cm to the east of the first one is slighly bigger and also heavily damaged. It is perfectly cylindrical with a diameter of 60 cm. The remains of the walls are scattered throughout the room.

Room 10I

This is one more room of Structure Complex 1, located on the northern side of structure 10G. The northern wall of structure 10G forms the southern wall of this room. The eastern wall of the room is not yet clear as it underlies the eastern section. The northern 4.70 m portion of the eastern wall of structure 10D forms the western wall of this room. The structure is delimited on the north by a partially exposed mud brick wall. It is exposed to a length of 1.90 m and has survived to a height of 1.0 m. The gap of 3.0 m between this wall and the western wall possibly indicates the entrance to the northern part of the complex. The exact purpose of the room cannot be determined as its major portion is still to be exposed.

Room 10J

It is a rectangular room, measuring 6.0 m (N-S) x 3.50 m (E-W), and is located on the northern side of the complex. Its western wall originates from the centre of the northern wall of room 10D. It is 7.0 m long, has an average width of 90 cm and is exposed to a height of 65 cm. Its northern portion is slightly tilted towards the west. The northern wall which separates rooms 10J and 10K, is comparatively narrow, having a width of only 45 cm. Only its foundation, consisting of two courses of stones, has survived to a height of 30 cm. It is 3.50 m long and is oriented E-W. The eastern wall is 7.0 m long, has a width of 40 cm, and has survived to a height of 75 cm. There are a couple of circular burnt patches inside this room but they do not seem to represent regular fireplaces as the burning is very superficial. This room also contains a circular silo with a diameter of 1.03 m and a depth of 51 cm. It is located along the western wall, 53 cm south of the northern partition wall.

Room 10K

This room is separated from room 10J by a thin partition wall. Only its western wall is preserved. The room was probably open on the east as there is no trace of a wall on this side. The northern wall seems to have been destroyed possibly by structure no. 25 of Phase III. Its southern wall is the same as the northern wall of room 10J. Its western wall is an extension of the western wall of room 10J. It is 3.60 m long and 90 cm wide, and has survived to a height of 56 cm. Its northern portion has become slightly inclined towards the west.

In the southeastern corner of this room there is a roughly circular feature which is lined with stones on the eastern side. It is 1.25 m (N-S) x 1.0 m (E-W) and is 35 cm deep. According to one of our labourers, Shri Chenram Kesaji, this feature, may have been used for keeping poultry. The contents of rooms 10I, 10J and 10K suggest that they were used for dwelling.

Structure complex 1 is so large that the excavations carried out over four seasons have not yet been able to uncover its entire plan. The size of the complex and the solidity of its construction, the presence of several silos and above-ground storage bins, two kitchens, a number of fireplaces, numerous querns, and large quantities of pottery and animal bones, all suggest that it was probably owened by a large and prosperous family. It is clear that many rooms of the complex were meant for dwelling, storage and cooking. There is no evidence of any industrial activity inside the complex.

Structure Complex 2

This complex, consisting of structure No. 9, is located on the western side of the street and was partially exposed in the second season (1994-95) (Misra *et al.* 1995). No further digging has been carried out here because priority was given to uncovering the fortified enclosure and to establishing the relationship between it and Complex 1.

Structure Complex 3 (Structures 11, 13-15)

The third complex is represented by structures 11, 13, 14 and 15 and is located to the south of Complex 2 (Structure 9). Complexes 2 and 3 are separated by a small, narrow lane which is 9.45 m long and 1.60 m wide.

Structure 11

This is a roughly rectangular enclosure with structures 13, 14 and 15 inside it. Only the eastern and northern walls of the enclosure have been fully exposed while its southern and western walls have been badly damaged possibly in the process of ploughing. The northern wall, exposed in the previous season, runs in an E-W direction. It is 9.45 m long, 90 cm wide and has survived to a height of 90 cm. It is made of mud bricks and rests over a single course stone foundation. The eastern wall runs in a N-S direction for 4.90 m and then turns to the east for a length of 1.30 m. It again turns to the south and runs almost straight for 11.60 m. Its average width is 70 cm. At a distance of 2.40 m from its northeastern corner there is a 1.20 m gap in the wall probably representing an entrance to the enclosure. A part of the wall near both ends of the gap is made of mud bricks laid horizontally while the remaining portion is made of flattish stones set in mud mortar.

Structure 13

Structure 13 is situated in the eastern part of the enclosure (structure 11). It is 2.80 m to the west of the eastern wall, and 8.25 m to the south of the northern wall of the enclosure. It is roughly square on plan with rounded corners. It is 5.60 m long (E-W) and 5.50 m wide (N-S). Isolated patches of a well-made mud floor, which is rammed hard and plastered with mud and cow dung, have survived in this structure. The northern wall of the structure is made of black clay, with an average thickness of 55 cm. The eastern wall, also with a width of 55 cm, is partly made of mud bricks and partly of black clay. A gap of 1.30 m in this wall near the southeastern corner suggests an entrance to the structure. There are traces of lime and cow dung plaster on the outer face of the wall. The southern wall is entirely made of mud and is 80 cm wide. The western wall is made of mud bricks and has an average width of 60 cm.

Almost in the central part of this structure there is a roughly circular fire-pit with a diameter of 80 cm. It is 50 cm to the south of the northern wall and 1.55 m to the west of the eastern wall. This may have served as a community cooking place.

Structure 14

This structure is located immediately to the west of structure 13, 4.15 m to the south of the northern wall of the enclosure. It is rectangular on plan, with walls surviving on three sides. The lower portion of the walls is made of flattish stones set in mud mortar. An opening on the southern side suggests an entrance. The structure has a well-made mud floor, rammed hard and plastered with mud and cow dung. Its northern wall is 5.20 m long and 70 cm wide, with two courses of the stone foundation surviving. A small portion of the wall, near the northeastern corner, is damaged by a later pit. The eastern wall is 4.70 m long and is only 60 cm broad. Only its basal course has survived. The western wall, of which only 2.90 m survives, is badly disturbed by ploughing. The function of this structure cannot be determined as it is devoid of any features like a hearth or storage facility.

Structure 15

This structure, located 30 cm to the west of structure 14, is roughly circular on plan with a maximum diameter of 2.70 m. It has 40 cm thick mud walls on all sides. The presence of burnt mud lumps, a pile of loose stones and mud inside the structure indicate that it was destroyed by fire. The structure has a 20 cm deep well-made sunken floor. In the absence of conclusive evidence it is difficult to determine the function of this structure.

Silos in Structure Complex 3

The northern portion of the enclosure (structure 11) which is open, flat and compact may have served as a courtyard. Two roughly circular silos were exposed in this area.

One of the silos is located in the northeastern part of the enclosure, 1.70 m north of the northern wall and 40 cm west of the eastern wall. It is roughly oblong on plan and measures 1.70 m (N-S) x 1.40 m (E-W) and is 55 cm deep. The presence of traces of decomposed grass and lime on the sides and base of the silo suggests that it was first plastered with lime and subsequently lined with grass.

The second silo is located 2.40 m southwest of the first one. It is circular in shape with a diameter of 1.60 m and a depth of 52 m. Its base is perfectly horizontal, and this as well as the sides of this silo were also first plastered with lime and then lined with grass. These silos suggest that the storage area of this structure was located in the open. Located on the periphery of the settlement, this structure is the most modest of the three complexes exposed so far.

Structural Phase III (Structures 8, 16, 23-25)

A number of structures of this phase were exposed during the last two seasons. They are sealed by layer (14), but none of them is intact. The absence of large and well-built structures in this phase suggests a decline in prosperity. However, there was not much difference in the nature of construction and the raw materials used. Most of the structures were either single or double-roomed and their walls were made of mud and mud bricks and the foundations of stones. This structural phase has provided excellent evidence of pottery manufacture.

Structure 8

This structure, located to the north and east of structure 5, was partially exposed in the second season (1994-95). Excavations during the last two seasons have cleared its northern limits. Its southern wall was completely damaged by ploughing and its western wall has not yet been exposed. The eastern wall, earlier exposed to a length of 7.50 m, now extends to a length of 9.80 m. It has survived to a height of 1.22 m, of which the lower 60 cm forms the foundation. The floor of the structure is exposed in its northeastern corner in an area of 3.0 m (N-S) x 1.90 m (E-W) at a depth of 72 cm from the top of the surviving wall. It is made of a mixture of silt, clay and brick-bats, all rammed hard and plastered. The northern wall, which is oriented slightly NE-SW, is exposed to a length of 8.90 m. It is 60 cm broad and has survived to a height of 1.20 m. It is built of stones of an average size of 35 x 21 cm. Traces of mud plaster in the northeastern corner suggest that the walls were plastered.

The structure had three rooms which are divided by walls made of mud bricks set in mud mortar. The easternmost room (longer axis in N-S direction), is 3.0 m long and 1.90 m wide and comparatively narrow. The partition wall has survived to a length of 4.50 m, a height of 80 cm and a width is 50 cm. Five horizontal courses of bricks are visible. The middle room, in which is located a pottery kiln, is the largest of the three rooms. The western partition wall is narrower (32 cm) compared to the eastern partition wall. It is 4.50 in length and has survived to a height of 50 cm. The room measures 5.0 m (E-W) x 4.50 m (N-S). The third room, located on the western side of the middle one, is exposed for an area of 4.50 m (N-S) x 2.0 m (E-W). An area of 1.90 m (E-W) and 1.60 m (N-S) of this room was heavily burnt to a thickness of 50 cm. The mud along the walls and on the floor is heavily burnt to a deep ochre colour. There are also patches of dark grey ash on the floor as well as in the northern and western sections. At least three large wide-mouthed jars of Thick Red-Slipped Ware were preserved in situ in a broken condition. One of the jars yielded a large quantity of charred mustard seeds. This multi-roomed structure, located on the western side of the mound, appears to have been occupied by a potter.

Structure 16

At the base of layer (14) a roughly rectangular structure was exposed in trenches OC1 and OC2. It is divided into two parts by a partition wall. The southern part is numbered 16A and the northern 16B. Two phases of this structure are visible. The earlier phase is in the middle of layer (15) whereas the later one is on top of this layer.

Earlier Phase of Structure 16A

This structure located in the southern half of trench OD2 and roughly rhomboidal on plan,, is relatively intact compared to the room of the later phase. The northern wall of this room, running in an E-W direction, is 3.70 m long and 60 cm wide. It has survived to a height of 25 cm. The eastern part of the room is quite narrow. The eastern wall has remained intact to a maximum height of 95 cm. It is slightly broader at the base (65 cm) compared with the upper part which is only 50 cm broad. This wall, which runs in a slightly NW-SE direction, is 2.20 m long.

It appears that the portion of the southern wall (which runs in a slightly NE-SW direction) of Structure Complex 10A-10K of Phase II, was intact when structure 16A of Phase III was constructed. The people who built this later structure seem to have taken advantage of the surviving intact wall of the earlier phase (structure 10) to use it as the southern wall of the new structure. This wall is 4.50 m long and 50 cm broad, and has survived to a height of 60 cm near the southeastern corner of the structure. The western wall of this room was constructed parallel to the surviving support wall of an earlier structure (10C). It is oriented in a N-S direction, is 2.50 m long and 50 cm broad.

Earlier Phase of Structure 16B

This is located to the north of structure 16A and shares a common wall with the latter. The support wall of structure 10C of the earlier phase forms the western wall of this room. The northern wall of this earlier phase is beneath the wall of the later phase. This wall, running in an E-W direction, is exposed to a length of 7.70 m but its width is not yet clear. The dimensions of the room exposed so far are 7.70 m (E-W) x 4.00 m (N-S). In the absence of any significant quantity of pottery and other artefacts the exact function of these rooms is not yet clear.

Later Phase of Structure 16A

The major portion of this structure was destroyed by ploughing and only its northeastern corner is preserved. Its northern wall, running in an E-W direction and preserved only in its basal portion, is 4.30 m long and 70 cm wide. Along the inner side of the wall there is a parallel alignment of stones at a slightly lower level. It is 3.05 m long and 51 cm wide. This could be a sitting platform inside the room. The eastern wall of the room is quite intact and 2.55 m x 65 cm x 70 cm still survives.

On the outer side of the eastern wall there are a number of post-holes with an average diameter of 22 cm and a depth of 42 cm. Along its inner side there are several large flat stones arranged in a N-S direction. This feature covers an area of 1.90 m x 1.50 m, and it too probably represents a platform. In the northeastern corner of this structure there is a large saddle quern.

Later Phase of Structure 16B

This structure is located on the northern side of structure 16A. It is roughly rectangular on plan with its longer axis in an E-W direction. It covers an area of 4.40 m (N-S) x 5.70 m (E-W). The northern wall of 16A forms its southern wall. Its northern wall is 45 cm wide and is made of mud. It had a foundation of stones of which three courses are preserved. Parallel to this wall there is a stone alignment which is 3.90 m long and 1.05 m wide. It has traces of mud and cow dung plaster and probably represents a platform. The presence of stone platforms and a saddle quern suggest that both the rooms, 16A and B, served as dwellings.

Structure 23

While digging in layer (5) in the northern half of trench H4, the southwestern portion of a mud brick structure was exposed. Its plan will be clear only when it is fully exposed. The foundation is made of small rectangular stone blocks above which stands a broad mud brick wall. The average size of the bricks is 33 x 18 x 12 cm. The southern wall of the structure is exposed to a length of 2.90 m and runs more or less E-W. The average width of this wall is 1.0 m, it has survived to a height of only 15 cm and its outer face bears traces of mud plaster. On the outer side of its southwestern corner flat stones have been added to strengthen the wall. The western wall, running N-S, is exposed to a length of 1.65 m and it has an average width of 1.0 m. A well-made floor of this structure has been exposed on the inner as well as the outer side. This structure is assigned to the third structural phase mainly because one more structure was noticed above it in the same trench.

Structure 24

This is a rectangular structure with a surviving length of 5.80 m (N-S) and a width of 2.90 m (E-W). Only its northern and eastern walls are preserved in trenches OA1 and OB1. Both the walls are made of stones set in clay mortar. Their average width is 55 cm and height 20 cm. The floor of the structure is relatively well preserved. It is made of alternate layers of brown silt and black clay, rammed hard and plastered with cow dung. A small circular fireplace was noticed on the floor. A number of broken pots of coarse Red and Grey Ware were found near the inner as well as outer periphery of the structure. Most probably this was a dwelling structure.

Structure 25

A two-room rectangular structure, located to the south of the fortified enclosure. Its major portion lies in trench A but a part of it extends into trenches A1, AX1 and AY1. The structure is divided into two parts by a thin partition wall made of relatively smaller stones. This wall runs in an E-W direction and it has survived to a length of 3.45 m and a height of 25 cm. Its average width is 55 cm. The wall is damaged near its eastern end and therefore its complete length cannot be determined.

Only the western and northern walls of this structure have survived. They are much thicker than the partition wall. The western wall has survived to a length of 7.80 m. Its average width is 75 cm. Only the basal course of this wall has survived towards the northern end whereas towards its southern end at least 3 courses of stones have survived to a height of 70 cm. The northern wall is better preserved. It has an extant length of 8.0 m and a height of 50 cm. There are two phases of this wall. The earlier one is 90 cm broad while the later one 65 cm broad and has survived to a length of 6.40 m.

The northern room of the structure is 2.40 m broad and has survived to a length of 3.40 m. The southern room is 3.10 m broad. The eastern periphery of these rooms cannot be determined because of large-scale damage. The size and nature of these rooms suggest that they were part of a dwelling structure.

Structural Phase IV (Structures 7 and 18)

Represented by only two structures so far, this is the last structural phase of the Chalcolithic period and is found on the top of layer (14) on the southern side of the mound. Other structures of this phase are likely to have been destroyed by the farmer while converting the mound into agricultural land. The small size and flimsy nature (represented by low mud walls over stone foundations) of the structures suggest a significant economic decline during this phase. Large boulders of different shapes and sizes were used to construct the foundations. There is little evidence of the use of bricks in this phase.

Structure 7

This structure, detected in the second season (1994-95) and completely exposed during the last two seasons, is represented only by a wall running in a slightly NW-SE direction and surviving only up to a length of 8.0 m and a width of 75 to 80 cm.

Structure 18

At the base of layer (13) in the eastern half of trench OA a structure represented by a single course of foundation stones was noticed. Remains of its northern, eastern and southern walls suggest that the structure was rectangular on plan. The eastern wall of the structure runs slightly in a NW-SE direction and 3.55 m survive. Possibly there was one more room on the southern side of the structure as the southern wall appears to be a partition wall. It is made of small, flattish and roundish stones, with an average size of 40 x 15 cm. It lies perpendicular to the eastern wall in an E-W direction. It has survived to a length of 2.85 m. The northern wall of this structure was exposed in the NW quadrant of trench OA. It runs in an E-W direction and has survived to a length of 1.65 m, a width of 70 cm and a height of 40 cm. Since a very small portion of the structure has survived it is difficult to determine its exact function.

The architecture of Balathal reflects the influence of the Harappan sites in Gujarat like Surkotada (Joshi 1990: 41-58), Rojdi (Possehl and Raval 1989: 26-52), Kuntasi (Dhavalikar *et al.* 1996: 43-91) and Dholavira (Bisht 1991). Harappan urban settlements consisted of two components: a citadel for the residences of the aristocracy, built on artificially raised ground, on the western side; and a lower town for the residences of the common people on the eastern side of the settlement. The lower town is divided by straight and parallel roads and streets running perpendicular to them. Smaller settlements or towns do not have this twin-unit pattern but they usually have a rampart or defence wall around the settlement. In the Harappan city and town settlements in Gujarat structures (citadel, rampart and lower town) were built of stone, mud brick and mud. At Balathal, although there is no citadel, there is a massive fortified enclosure which is comparable to a citadel in the technology used, and the amount of energy expended on its construction. Further, the residential area is divided by a street and a lane, and the structures - fortified enclosure as well as residential complexes - are made of undressed and semi-dressed stones, mud bricks and mud. These parallels are too close to be treated as mere coincidences.

Comparable evidence comes from the two other excavated sites of the Ahar Culture in Mewar, namely Ahar (Sankalia *et al.* 1969) and Gilund (*IAR* 1959-60: 41-46). At Ahar the houses were made of stone and mud though there is no evidence of fortification or planning, perhaps because the excavation was very small. At Gilund, though, there is evidence of massive walls of brunt brick, a material which is known to have been used only by the Harappans during pre-Iron Age times.

No other Chalcolithc site in India has produced comparable evidence of elaborate stone and mud brick architecture as that found at Balathal. Only a few sites have yielded evidence of fortification. At Eran in Sagar District the Chalcolithic site is surrounded on three sides by the Bina river. On the fourth side a protective wall or rampart, surrounded by a moat, was built during the middle phase of Chalcolithic occupation. The rampart (also described as a fortification-wall and defence-wall) is 48.52 m in basal width and has an extant height of 6.40 m (*IAR* 1962-63: 11-12; 1963-64: 15-16; 1964-65: 16-18). It is built of black and yellow clay and its core contained Chalcolithic pottery. The wall was built in two phases. Initially, it had a basal width of 30.48 m and was separated from the moat by a gap of 15.34 m. This gap was subsequently closed bringing the total width to 48.52 m.

Evidence of a possible defence wall is also reported from Nagda, located on the river Chambal in the Ujjain district of Madhya Pradesh. Since the excavation was of a small size, the wall has been exposed only partially. The basal ten courses of the wall are made of mud bricks. According to the excavator it is built at an average height of 3.0 m above the natural black cotton soil. The exposed part has the appearance of a regular platform and has been suspected to be a part of defence works, but the fact that it stops short detracts somewhat but not altogether from the idea of defence. The exposed part measures 6.7 x 7.46 m and is 1.98 m in height. Traces of it have been found in two other trenches which had been deliberately laid for the purpose of tracing the wall, suggesting a large size and considerable length, running to at least 28.95 m. The defences represent the seventh structural phase in Period I. Mud bricks were extensively used in this construction (Banerjee 1986: 40; Pls. X A. XI).

Pottery Kilns

Kiln — Structural Phase III (CY1, NW and CY2, NE)

A large pottery kiln was discovered in the middle room of structure 8 in the second season and it has been fully exposed in the last two seasons. The kiln is enclosed by mud brick walls on three sides and by a stone wall on the northern side. The length of the kiln (E-W) is 5.0 m, width (N-S) 4.80 m and height 70 cm. The entire deposit inside the kiln is composed of heavily burnt earth, dark ash, charcoal, in situ broken pots and potsherds. The in situ broken pots were obviously placed in the kiln for baking.

The kiln was periodically repaired by making a fresh base of clay, suggesting that it was in use over a long period of time. The top surface of the kiln has several elongated and inter-connected channels for letting out gases from within. The channels run both E-W and N-S.

At the eastern end of the surface of the kiln there is an unusually large stone quern. It is 1.40 m long and is 95 cm wide. The entire surface of the quern is smooth and it is concave at both ends, obviously due to its prolonged use. The quern would appear to have been used for pounding and kneading the clay which went into the making of the pots as well as in the application of slip on the pots. The quern, however, does not show traces of burning, thereby suggesting that it was placed there after the kiln went into disuse and that it may be related to the kiln of the later phase (Structural Phase IV). This quern is totally different in size, shape and depth from the numerous other querns found in domestic structures at the site (Fig. 11).

Below the inter-connected channels on the surface of the kiln seven containers, circular in shape but of varying sizes, were found (Fig 12). They are made of clay mixed with chopped grass and are burnt brick red, obviously because of prolonged use. Some of them are packed with burnt clods. One has a few Red Ware sherds (Container No. 5) and one (Container No. 7) has a rectangular stamped design of about 5 x 3 cm consisting of a stemmed dish-like object in the centre and spirals on both sides.

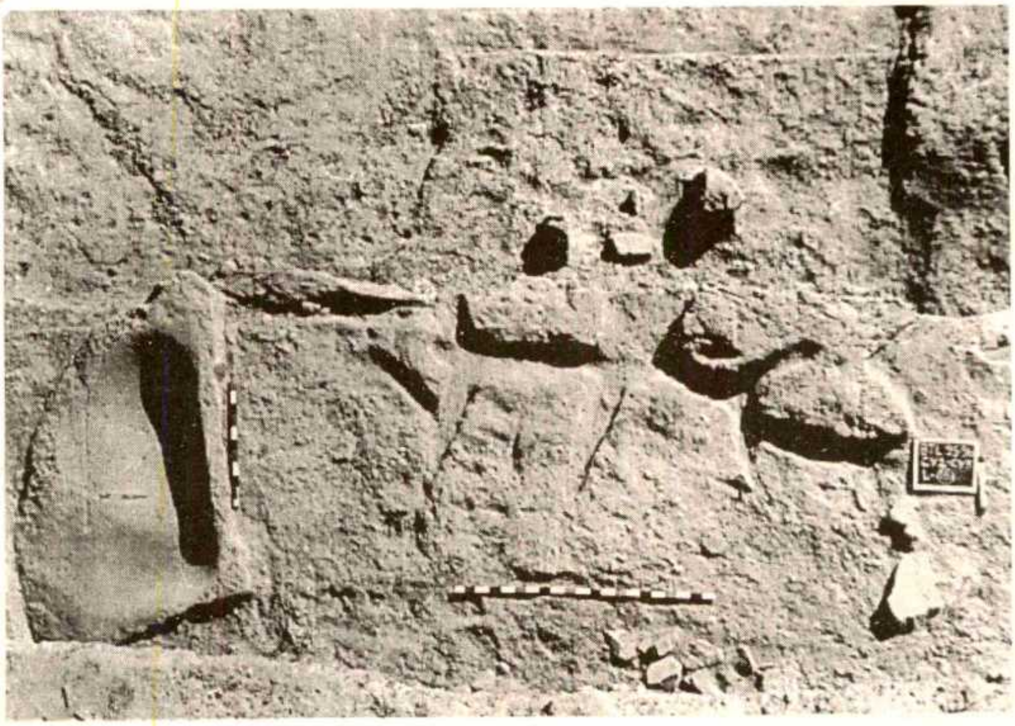


Fig. 11: Surface of the pottery kiln of Phase III, showing inter-connected channels for letting out hot gases, and an unusually large stone quern

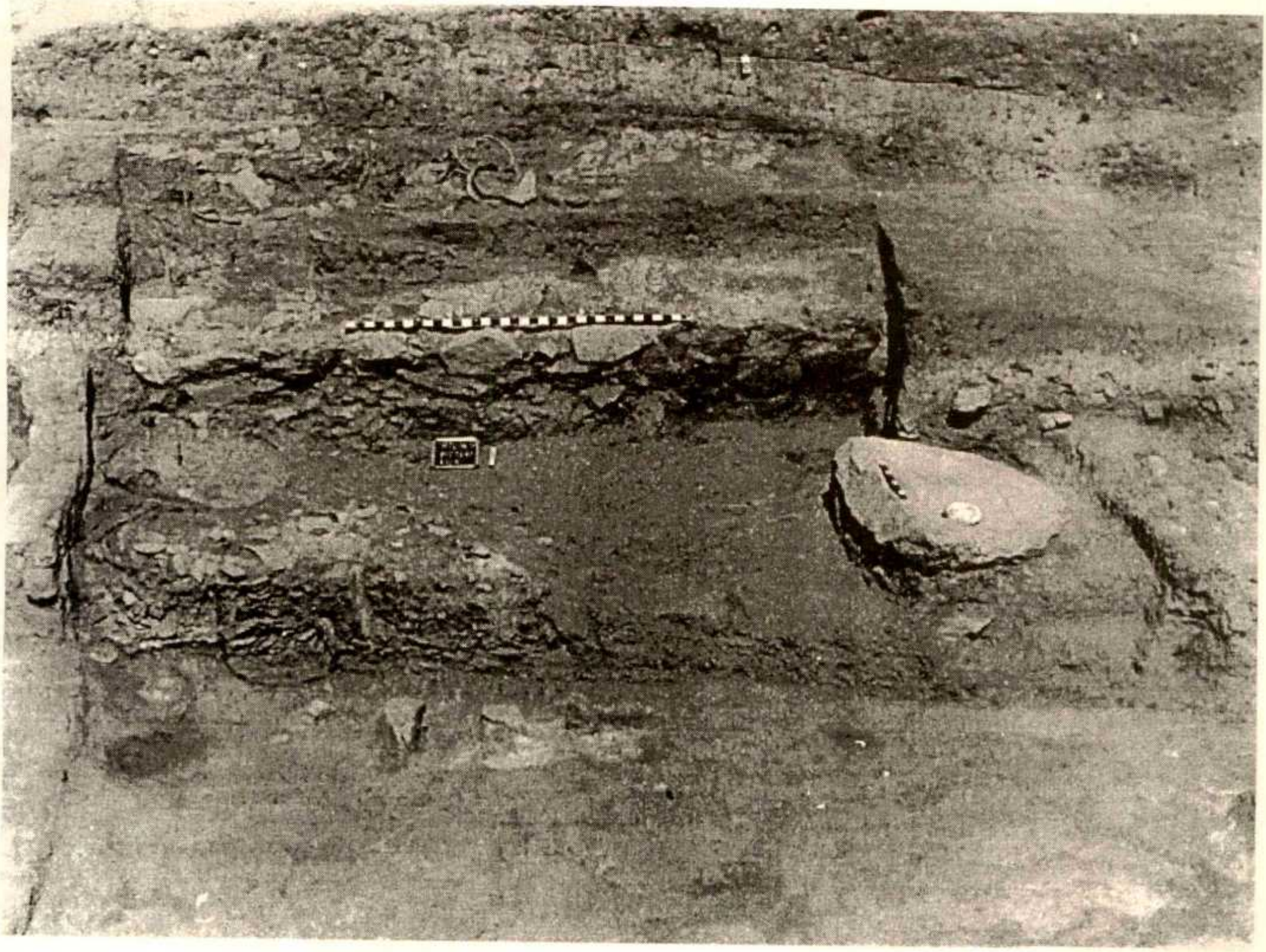


Fig. 12: Pottery kiln of Phase III showing circular clay containers at the base of the section

Kiln — Structural Phase IV

A second pottery kiln was unearthed at a height of 90 cm and immediately to the north of the first kiln of Phase III. It is 4.05 m long (E-W) and 1.40 m wide (N-S) but since its northern end is buried under the section, its full width is not clear. It has a deposit of 45 cm which is composed of burnt earth, clods of burnt earth and several pots broken in situ. The kiln is resting on a wall which is made of 60 cm thick stone courses and 30 cm of mud above these stones. This is the northern wall of structure No. 8. In its western part, over a length of 90 cm, the burnt part of the kiln rests directly on the stone wall.

Almost the entire surface of the kiln, except 40 cm at its eastern end, is covered with complete pots which have broken in situ (Fig. 13). They are mainly of Tan Ware and Thick Red-Slipped Ware and a couple of them are of Grey Ware. The Tan Ware pots include large wide-mouthed jars with one or two deep grooves between raised ridges on the shoulder, and an externally projecting rim; a deep basin with a prominent ridge on the shoulder about 5 cm below the rim which is flat; and large deep dishes or basins. The Thick Red-Slipped Ware pots comprise large open-mouthed jars with incised decoration of double bands of multiple wavy lines and groups of conical applique knobs below these lines. The Grey Ware pots comprise *handis* with broad, externally projecting rims, globular bodies and constricted necks. They are decorated on the shoulder with broad applique bands which have been obliquely incised.

The pots were placed in the kiln with their mouths upwards. They are completely filled in with clods of burnt earth which are probably a part of the collapsed clay walls of the kiln. This kiln provides clear evidence that Thick Red-Slipped Ware, Tan Ware and Grey Ware were manufactured at the site. Thin Red-Slipped Ware and Black-and-Red Ware were not found in either of the two kilns; they may have been baked in different kilns or in the same kilns on different occasions.

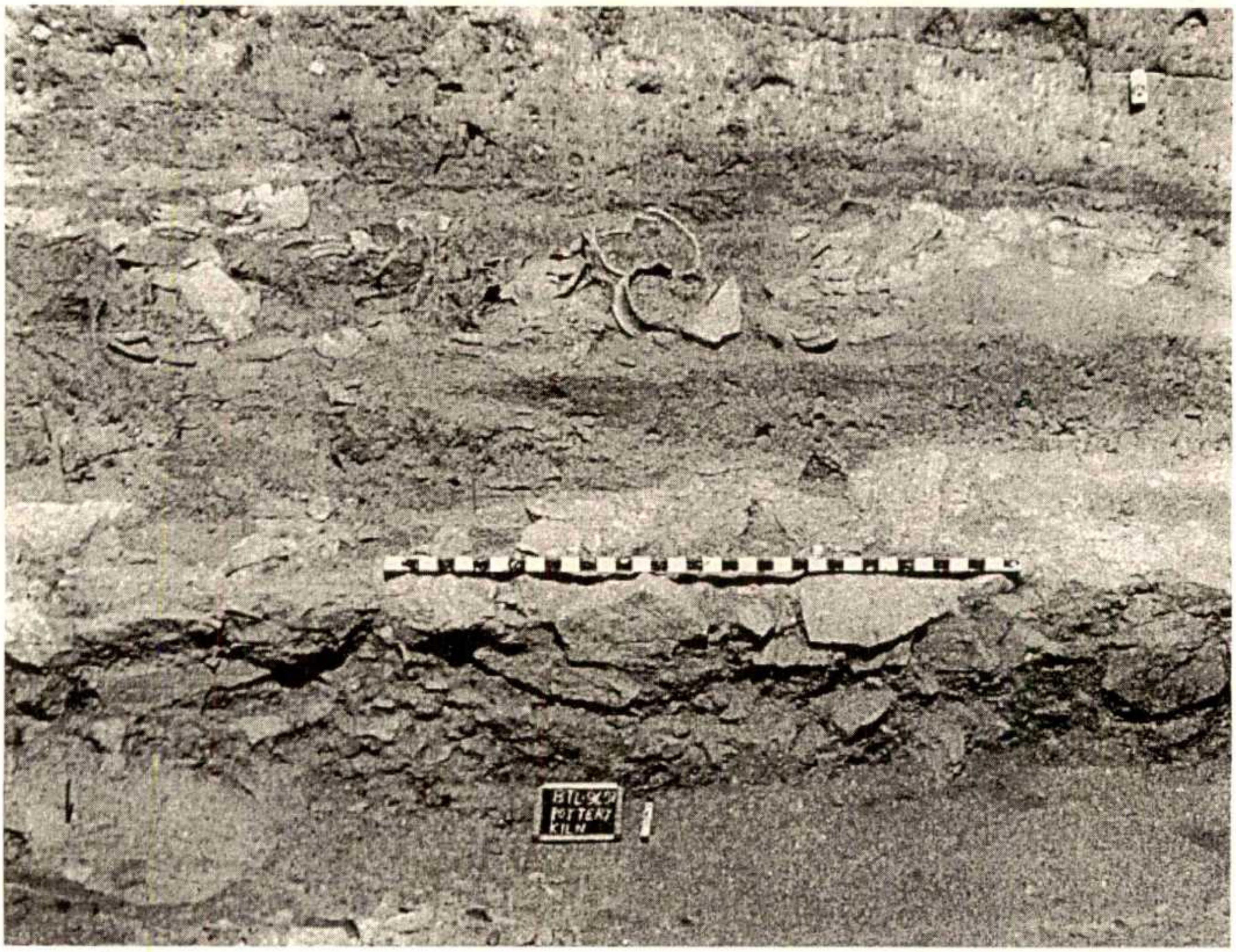


Fig. 13: Pottery kiln of Phase IV showing in situ broken pots

The discovery of these kilns is of special significance because it proves that pottery was manufactured at the site and that the potter's residence was located within the settlement.

Besides Balathal, only a few other protohistoric sites in the Subcontinent have yielded evidence of pottery kilns. An open-air kiln is known from Phase III (pre-Harappan) of Mehrgarh (Audouze and Jarrige 1979; Jarrige 1979: 82) and also from Phase 3 (Harappan) at Nausharo (Mery 1994: 474), both located in Baluchistan. From Periods VI and VII (Harappan) of Mehrgarh ovens for firing pottery have been reported (Santoni 1989).

At Mohenjo-daro several kilns are reported from the Harappan period. The main features of these kilns are a round pit for the wood or reed fuel and a domed compartment above to hold the vessels to be baked, communication between the two being effected by round holes in the floor of the upper chamber (Mackay 1938, Vol. I: 177).

More elaborate kilns are reported from the Chalcolithic site of Inamgaon in Maharashtra (Dhavalikar *et al.* 1988: 251-61). In the Malwa period a circular kiln with a high wall, nine flues at the base for the circulation of hot gas, and a long fire chamber is known. A broadly similar kiln was found in the Early Jorwe period at the site. This kiln had four oblong clay cushions, with a groove on each of the sides and a hole in the centre.

Even more elaborate kilns have been reported from Phase V (Jorwe Culture) of Daimabad in Maharashtra (Sali 1986: 125-133; Pls. XXXII-XXXVII). One of the kilns was built over a 5x5 m mud platform and had a nearly 1.4 m high and 1.0 m thick wall made of three layers. It had two stoke-holes on one side and a recessed opening in the centre of the platform. The kiln was divided into two parts by a 3 to 5 cm thick wall. Inside the kiln there were fifteen in situ crushed pots, potsherds, reddish gravel, charcoal and charred logs of wood. The second kiln was broadly similar in shape to the first one but slightly bigger in size.

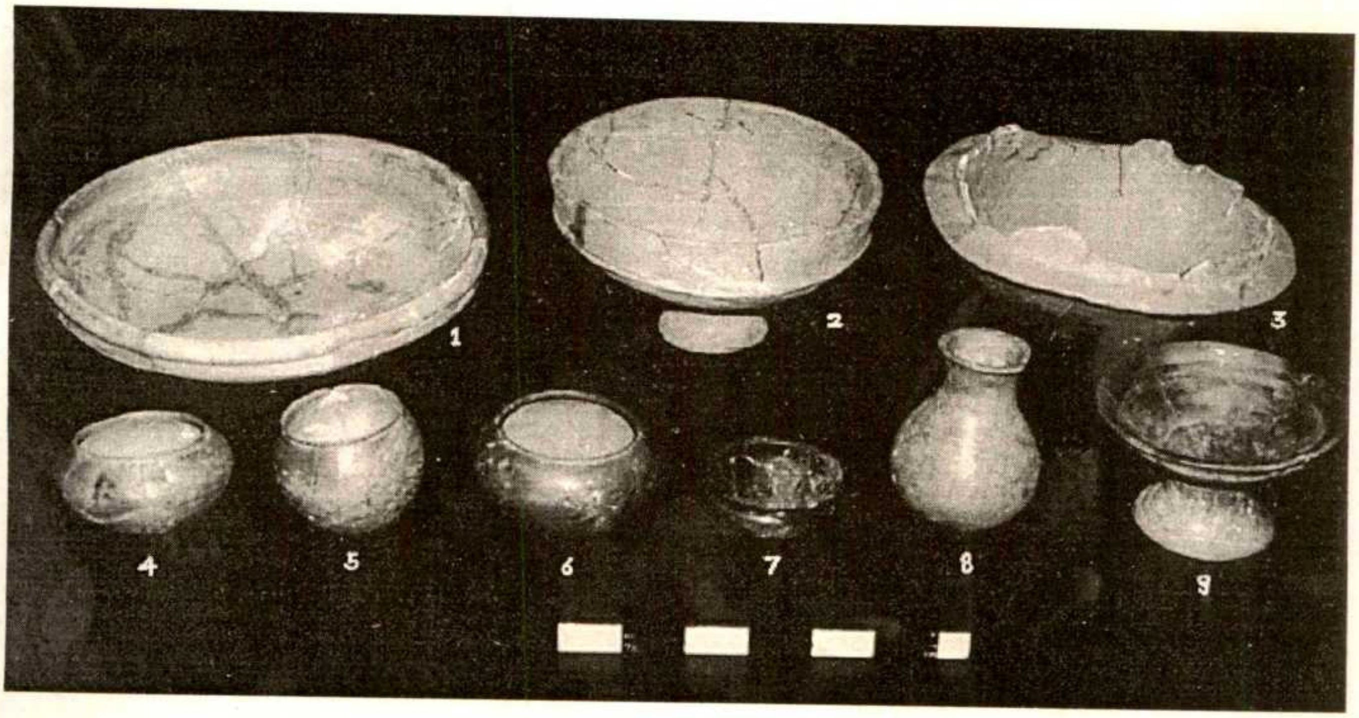


Fig. 14: Chalcolithic pottery: 1- large dish; 2- straight-sided deep dish or basin with low pedestal (Tan Ware); 3- basin with decorative projections on the rim; 4-6, bowls; 7- bowl (Black-and-Red Ware); 8- *lota* (Thin Red Ware); 9- dish-on-stand (Grey Ware)

Pottery (Fig. 14)

The principal ceramics known from the Chalcolithic levels of the site - Thin Red Ware, Tan Ware, Black-and-Red Ware, Buff Ware, Reserved Slip Ware, Thick Red-slipped Ware and Grey Ware, and their distinctive characteristics, shapes and designs — have been described in our earlier publication (Misra *et al.* 1995). No new wares have been found in the last two seasons' excavations. However, there has been some addition to our knowledge in respect of vessel shapes, decorative patterns, and manufacturing technology, particularly from the discovery of complete pots in the pottery kiln of Phase IV.

The complete pots, though broken in situ, belong to the Tan Ware, Thick Red-Slipped Ware and Grey Ware. In the earlier excavations the shapes in the Tan Ware largely consisted of dishes and the dish-on-stand. But now large wide-mouthed jars decorated with applique ridges enclosing one or two deep grooves between them, deep basins with a prominent ridge on the shoulder, and large deep dishes or basins are also known. There is considerable variation in the size of dishes in this ware and almost all dishes have stands. The stands also show considerable variety, comprising narrow as well as wide ring bases, and tall cylindrical stems with flared bases. The Tan Ware shapes are typically Harappan although decoration on them is rare. The discovery of Tan Ware vessels in a pottery kiln is significant because it clearly shows that this ware was manufactured at the site. Earlier, V.D. Gogte (1996) had opined, on the basis of X-Ray Diffraction Analysis of this ware and clay from the neighbourhood of the site, that this ware was imported by the people of Balathal from other sites.

Similarly, there is considerable variation in the size and shapes of bowls in Thin Red Ware and Black-and-Red Ware. In the Reserved Slip Ware some of the painted designs like intersecting circles are also typically Harappan. In the Thick Red-Slipped Ware several large jars with wide mouths and bearing profuse applique and incised decoration have been found.

Of special interest is the occurrence of Reserved
Ware. The characteristic feature of this ware is the technique employed in decoration. The vessels were first treated with a thin slip, usually of a light red colour. Af
this slip had dried, a second, slightly thicker slip of a different colour — bright red, black or buff — was
Before the second slip dried completely, it was p
removed by a comb-like object, thereby creatin
like bands of multiple straight or wavy lines a
crosses. In the spaces where the second slip wa
the surface of the first slip was exposed. The de
patterns therefore have a bichrome effect (Fig. 1

More than 100 sherds of this ware have bee
Balathal. This number is larger than that at any o
Because most of the sherds are small and lack ri

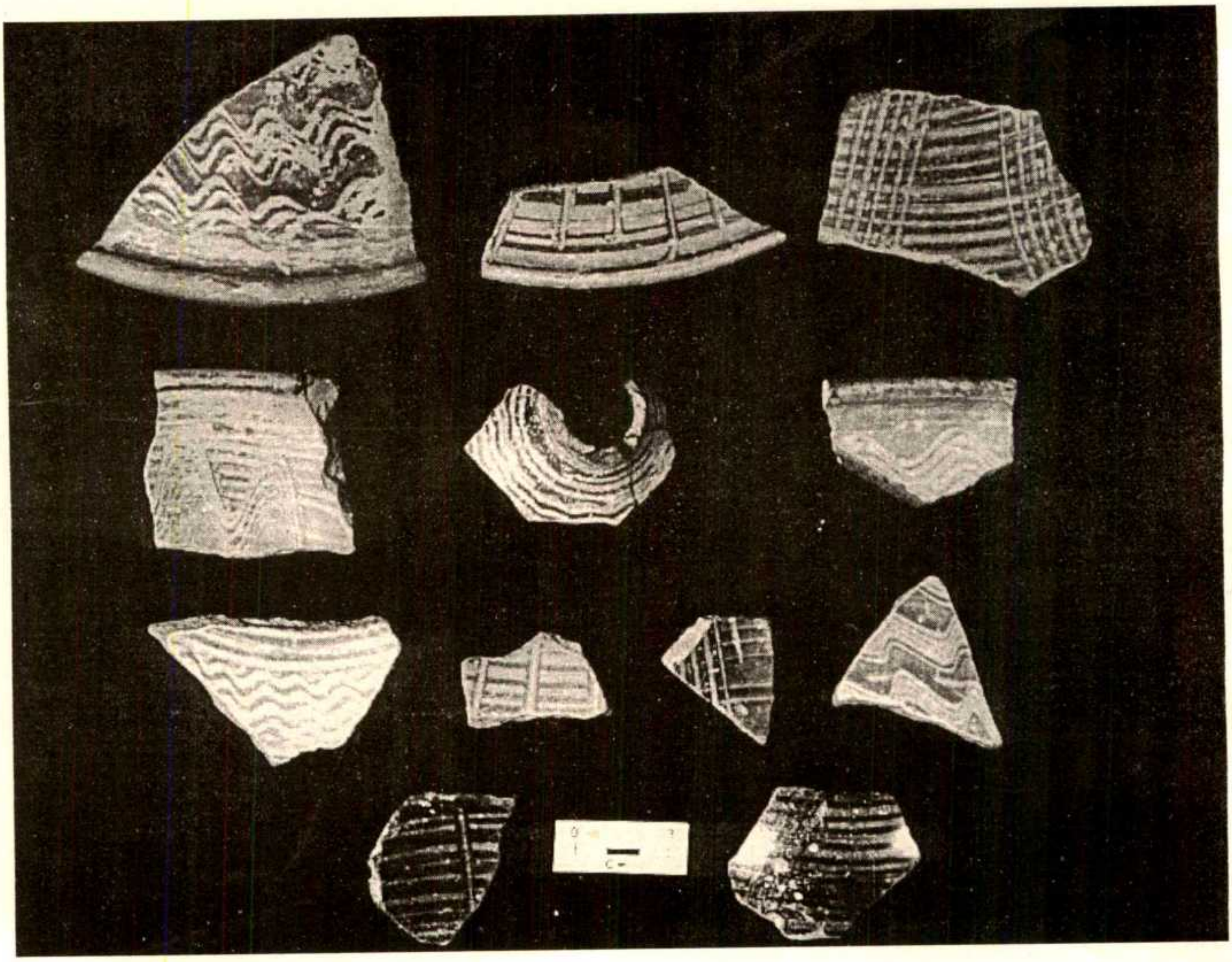


Fig. 15: Chalcolithic pottery: designs on Reserved Slip Ware

no vessel shapes can be identified with certainty. At present the only shapes indicated are a small, narrow-mouthed vase and a small dish with in-turned rim.

The ware is confined to the central and western parts of the mound which were occupied earlier than the other parts of the site and before the Balathal people came into contact with the Harappan people of Gujarat. Also, most of the sherds come from the lowermost layers (21-18) which antedate Harappan contact. This evidence negates the earlier view that the ware was introduced at Balathal through contact with the Harappans. This evidence is further supported by the results of the X-Ray Diffraction Analysis carried out on the sherds of this ware from Balathal by V.D. Gogte (personal communication). These results show that the ware was manufactured at the site using locally available clay.

Reserved Slip Ware is known only from a few protohistoric sites in the Subcontinent and at all these sites it is represented only by a very small number of sherds.

For example, seven sherds are known from the early levels of Mohenjo-daro (Marshall 1931: 578, Pl. CLIX.1-2; Mackay 1938:188, Pl. LXX.1-4) and three from the early levels of Chanhu-daro (Mackay 1943:72, Pl. XXXVIII. 26, 27, 29). From Lothal a few sherds have been reported from Phase II and Phase IIIA (*IAR* 1957-58: 13, Pl. XVI A; Rao 1973: 165)); and a solitary sherd is known from the pre-Prabhas deposit at Somnath (Joshi 1990: 74).

Some sixteen sherds are known from Surkotada (Joshi 1990:74-75): nine from Period IA-2 (Fig. 27, Nos. 11-19), one from Period IB-7 (Fig. 27, No. 10) and six from Period IC-1 (Fig. 27, Nos. 3-6, 8-9). The vessel forms comprise hole-mouth 'oil bottles', concave-necked small jars with rounded bodies and a solitary shallow basin. In Period IB hole-mouth vessels are absent and only the body fragments of bulbous jars have been found. In Period IC, only globular jars with concave and constricted necks and a shallow basin represent the old types. However, two new forms, a concave-necked wide-mouthed bulbous jar and the base of a dish/bowl-on-stand are found. A few sherds are also reported from other sites in in Kutch, like Desalpar IA (*IAR* 1963-64: 11), Kerasi, Pabumath, Lakhapar, Jhangar and Kotada (Joshi 1966: 65-67, Figs. 4 and 4B).

A small number of sherds of this ware are known from Mesopotamia from the Sargonid levels of Brak in the Khabur valley (Mallowan 1947: 191, Pl. XLIII.1-4) and T. Jidle on the Balikh (Mallowan 1946: 135) and from the Al-Ubaid levels of Ur (Rao 1973: 164).

Because of its rarity and the absence of identifiable forms, both Marshall and Mallowan had expressed their inability to identify the epicentre of this ware (Joshi 1990: 75). Joshi is of the opinion that in view of its rarity, its presence only at sites in Kutch and Mesopotamia, and its total absence at inland sites, 'this ware, the container of a rather rare commodity, was involved only in maritime traffic' (Joshi 1990: 75). Rao (1973: 164), on the other hand, states that the technique of Reserved Slip Ware 'is said to have originated in Jamdet-Nasr period and was imitated at several other centres in the Akkadian and post-Akkadian periods.' Accordingly, he has used the presence of this ware at Lothal, alongwith other evidence of trade contact with West Asia, to date the site.

In view of the greater incidence and higher antiquity of this ware at Balathal the possibility of its origin in the Ahar culture of the Mewar region should not be altogether ruled out.

Antiquities

Although the Chalcolithic phase has provided excellent evidence of architecture, suggesting a high degree of economic prosperity among the inhabitants, large quantities of ceramics of high technical quality, vast amounts of animal bones, mainly of domesticated animals, and plentiful remains of charred seeds of cultivated crops, it is rather poor in manufactured objects, other than ceramics. The first two seasons yielded about a dozen copper-bronze objects comprising choppers, knives, razors and one specimen each of a chisel, a tanged and barbed arrowhead, and a six-petalled flower-like object and bits of copper, some terracotta bull figurines and beads, beads of semi-precious stones, numerous stone querns, grinders, hammerstones, small terracotta balls and a few microblades, microliths and fluted cores. In the last two seasons, however, the number of metal objects and beads of semi-precious stones are very few. The only noteworthy finds of metal objects are one specimen each of a six-petalled flower-like object, a point, an ear-stud and a razor blade.

Chronology

Fifteen radiocarbon dates based on the analysis of charcoal samples from the site have been supplied by the Radiocarbon Laboratory of the Physical Research Laboratory, Ahmedabad (Table 1).

The first ten dates are derived from samples coming from Chalcolithic levels and they range from 3800 B.C. to

Table 1: Radiocarbon dates from Balathal

S.No.	PRL No.	Trench	Layer	Depth	Age in Years B.P.*
1.	1933	OE	23	4.98 m	5770 ± 100
2.	1928	HX2	18	4.68 m	4550 ± 180
3.	1834	OD	10	4.00 m	4350 ± 70
4.	1846	HX2	14	3.16 m	4310 ± 80
5.	1844	HX2	12	3.27 m	4300 ± 80
6.	1843	HX2	11	2.83 m	4120 ± 70
7.	1937	OB	16	2.05 m	3980 ± 90
8.	1835	F4	7	3.17 m	3830 ± 60
9.	1925	HX2	15	3.80 m	3810 ± 170
10.	1930	OE	21	4.71 m	3760 ± 110
11.	1850	C1	2	0.47 m	3530 ± 70
12.	1851	B4	4	1.40 m	3510 ± 70
13.	1849	C	3	0.90 m	2290 ± 70
14.	1841	HX2	3	0.84 m	2110 ± 60
15.	1848	C	2	0.50 m	1820 ± 70

* Based on half-life of 5730 years

1800 B.C. Barring the first date, which is nearly 1200 years older than the next oldest date, all other dates are reasonably consistent. Thus, excluding the first date, the duration of the Chalcolithic culture ranges between 2600 and 1800 B.C. However, so far we have only two dates, including the deviant one, from the lowermost levels. Therefore, there is a strong possibility that when more dates become available from the lowermost levels, the antiquity of the settlement will go beyond 2600 B.C. Even on the basis of presently available dates, Balathal would be the oldest known village outside the domain of the Indus (Harappan) civilization.

Two dates (Nos. 11 and 12) come from layers of the Early Historic period but they are too old for this period. It is possible that because of the disturbance caused by the Early Historic occupation of the long-abandoned site, older samples got into the layers of the Early Historic period and therefore the dates are older than expected. If that be the case, then the upper limit of the Chalcolithic occupation goes to the middle of the 16th century B.C. The dates (Nos. 13 to 15) come from the Early Historic levels and they range from 340 B.C. to 130 A.D., i.e. covering the time from the Mauryan to Kushana periods which is consistent with the archaeological data.

Origin and Development of the Chalcolithic Culture

An examination of the architectural remains, ceramics and other material equipment recovered from Balathal provide some evidence for the development of the Chalcolithic culture which can be divided in two phases. Phase A is represented by layers 21 to 18 and Phase B by layers 17 to 14.

In Phase A the architecture is very simple, consisting of circular mud floors plastered with cow dung and lime as seen in trench HX2. Over these floors probably huts of wattle-and-daub were raised, as indicated by burnt clods of mud. However, the discovery of two deep silos lined with grass and lime plaster in trench HX2 shows that the inhabitants produced surplus food grains. This is significant because the area excavated of the early phase is very small. Associated with the silos and even outside of them a number of large, heavily worn querns were found. The use of stone and mud brick for construction was not known in this phase.

There is a marked change in the size of structures and the materials and techniques used in their construction from the beginning of Phase B. The architecture of this phase is marked by the extensive use of semi-dressed and undressed stones and mud bricks. Four architectural phases have been identified in this cultural phase. Phase I is so far represented only by two small walls — one in trenches FY2 and GY2 and the other in trench OF2. Both these walls are made of stone. Phase II is the most prosperous. It is best represented by the fortified enclosure and multi-roomed Complex 1. These are characterized by large and massive walls of stone, mud brick and mud. There is evidence of incipient planning of the settlement. The fortified enclosure is located in the centre of the settlement surrounded by residential quarters. Both these structures are indicative of considerable prosperity and, seen along with modest structures of Complex 3, HX2, and D2, provide evidence of stratified economic and social organisation. Phases III and IV represent economic decline.

The architectural evidence is supplemented by ceramic evidence. It is noticed, particularly in the lowermost levels of HX2, that some of the characteristic wares such as the Thick Red-slipped (coarse variety), Thin Red, and Black-and-Red, were introduced by the original settlers. The pottery found in the last three layers (21-19) in HX2 is quite coarse, thick in section, ill-fired and the majority of the vessels were handmade. A variety of shapes such as wide-mouthed deep carinated bowls, small narrow mouthed jars, storage jars with beaded rims, which are some of the fossil types in these wares, were introduced by the first farmers at the site.

A gradual development is seen in these wares in terms of technology, shapes and designs. These wares introduced by the first farmers were gradually transformed into finer varieties in the middle phase of the Chalcolithic period (around 2400 B.C.). There is also a qualitative change in the raw material used and in the firing technique. Gradually, the pottery becomes thinner in section, better-fired and there is greater use of the wheel for fashioning the pots. Most of the wares become perfectly mature in layer 17. The evidence of the origin and development of the Chalcolithic ceramic tradition is confined to the central and western parts of the mound. Limited digging carried down to the natural level in the southern half of trenches OE and the northeast quadrant of OB1 has not yielded any evidence comparable to that found in the lower levels of trenches HX2 and D2. It appears that the initial occupation was confined to the central, western and probably northern parts of the mound, and the southern part was occupied at a later date. The evidence from the excavated areas suggests the entire site came under occupation only in the middle phase (layers 17 to 14) around 2400 B.C. This phase also witnessed a remarkable increase in prosperity, best exemplified by the architecture, probably as a result of contact between the Balathal people and the Harappans of Gujarat.

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A Preliminary Report on the Characterization of Copper and Gold Ornaments of the Arippa Megalithic Culture in Kollam District, Kerala, South India

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Abstract

During an archaeological excavation of two cist burials at Arippa (8°50'10"; 77°01'23") near Madathara in the Kollam district of South Kerala, rich megalithic cultural material consisting of a stone tool, numerous iron implements, pottery, three gold-earrings, a copper bangle, an infant's cranium, human bones, animal bones and food material were found. The food material was not charred but was also unidentifiable due to the poor state of preservation. Such rich cultural material had not been discovered earlier from any excavated site in Kerala.

The Megaliths

These cist burials are found at Arippa near the foothills of the Western Ghats. They form two adjacent rectangular chambers 60 cm below the surface. They have a common slab at the centre and each of them consists of 5 slabs. The orthostat on the longer side is 191 cm long and 180 cm high, while the end slab is 105 cm long and 180 m high. Their thickness ranges from 10 to 19 cms. The bottom and the top of these chambers were closed with bigger slabs and the cists were completely filled up with fine soil which is different from the surrounding gravely lateritic soil. One of the cist chambers (T1) has a depth of 145 cm on the inside while the other (T2) is 180 cm deep. None of these chambers have port-holes on the orthostats and they appear to be the product of a single burial (Fig. 1).

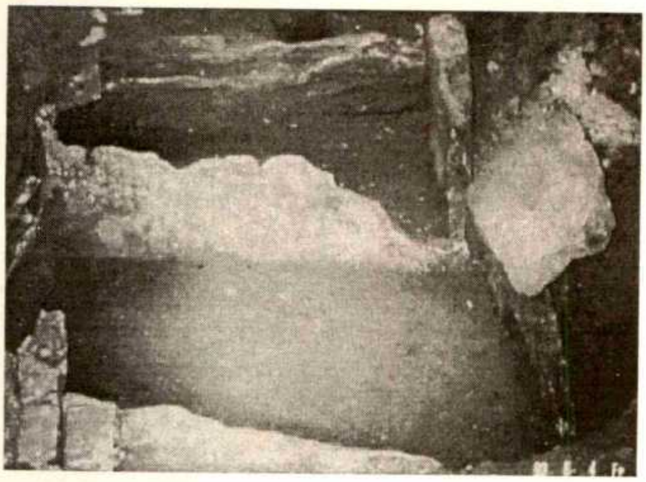

Fig. 1: Arippa: cist burials

The Cultural Material

The gold and copper ornaments along with the iron implements were found at the very bottom of the chamber and were not within the pots. Out of the three gold earrings one was found in the chamber of T1 while the other two were found in T2. The solitary copper bangle (Fig. 2a) and a bifacial point made of quartz were found in T2. Both the cists have yielded a number of heavy and light duty iron implements which are heavily encrusted and corroded. Most of them have socketed handles in which there are remnants of wood, indicating the use of wooden handles.

The slotted earring comprises a copper ring covered by gold foil (Fig. 2b). The iron implements consist of tools and weapons which include a cutting tool, sickles, knives, ploughshares, daggers, swords, etc. (Fig. 3). The cutting tool is a unique heavy implement (42 cm long), with a single cutting edge (11 cm in the middle) and with curved solid handles at both the sides. There is a projection in the centre opposite the cutting edge and the tool is made from

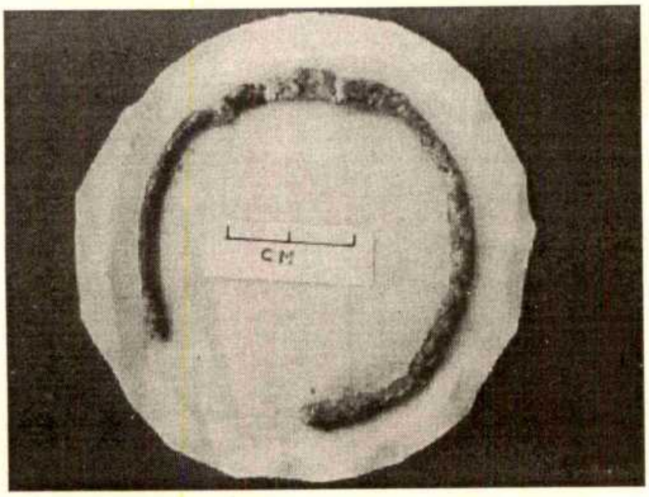

Fig. 2a: Arippa: copperbangle

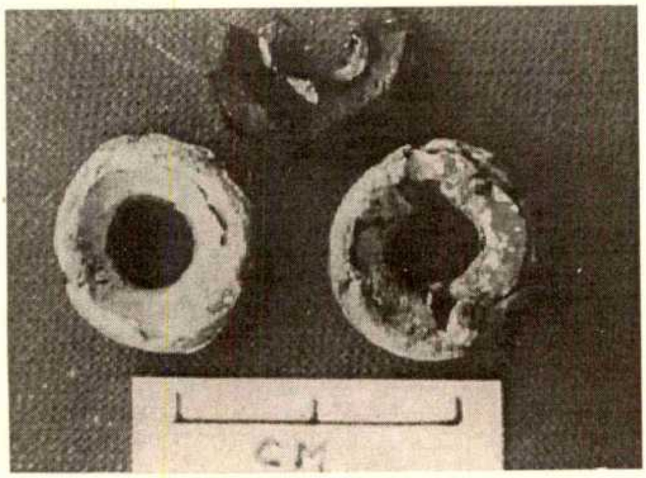

Fig. 2b: Arippa: slotted ear-rings

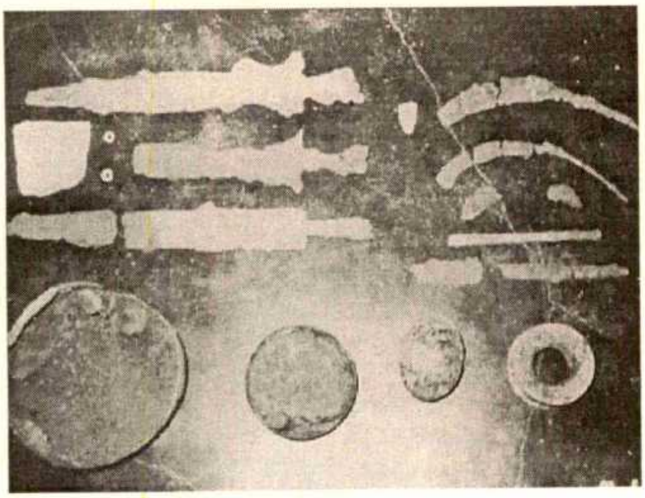

Fig. 3: Arippa: other antiquities

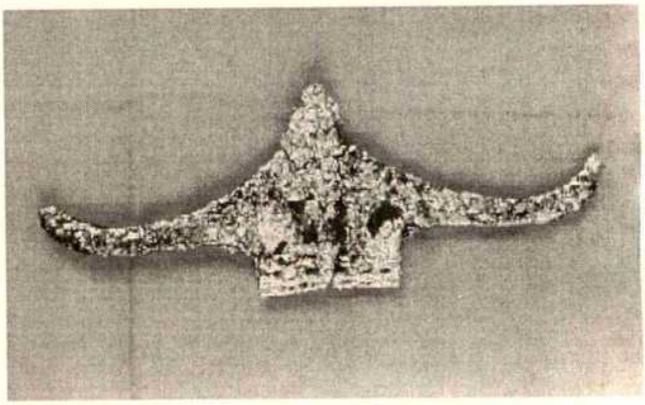

Fig. 4: Arippa: a unique cutting tool

a single mould (Fig. 4). As there is evidence for indigenous iron metallurgy during the Megalithic period from Kalluvacha and Abhayagiri in Kuvakkad near Kulathupuzha (Kollam District) and from Ezhuvannikonam Bharathannur (Thiruvananthapuram District) (Rajendran 1995) we would like to suggest that the above mentioned implements are locally manufactured.

The occurrence of gold and copper ornaments at Arippa is also significant in this context. In Kerala, gold in its natural form is still seen in the Nilgiri ranges and in the Beypore river basin while iron ore reserves are reported only from Calicut and Malappuram districts, both in north Kerala. Gold sieving in the higher reaches of the Beypore river bed has been carried out by the local people over a long period of time. This might have been the source of the gold used by the Megalithic people in Kerala. The copper sources used by them, however, are yet to be identified.

Pottery consisting of cups, lotas, lids, bowls, pot-rests, etc. were also found in these two cist chambers (Fig. 3) and include Red Ware, Black Ware, Black-and-Red-Ware, and Grey Ware. The black or red slip used in certain cases is of a high quality. The pottery is generally wheel made and well baked.

Radiometric analysis at the Regional Research Laboratory, Thiruvananthapuram has shown that the Megalithic potsherds from Arippa, Karimpalur and Embeeran have in them the radioactive elements such as U, Th and K^{40}. These elements are common in the soils of Kerala, particularly in river basins. This probably confirms that the pots were locally made. These pots have shown very high radioactivity and it was noted that one of the TL parameters, alpha efficiency, was abnormally high, i.e., 0.3 compared to 0.15 in most cases (A.K. Singhvi: personal communication).

In cist T2 most of the pots and bowls have poorly preserved food grains at the base and all of them were filled with fine soil or coarse river sand, or a combination of both, while the pottery in T1 was filled with different types of soil and did not contain any food grains. Human and animal remains in the form of bones were found only in three pots and a bowl in T2. One of the small pots contained an infant cranium minus the teeth, suggesting an age of less than six months. The bones in the other pots resemble adult human bones along with a few animal bones. They are almost completely decayed leaving only their moulds. None of them show any evidence of burning, and the presence of a few bones probably indicates a secondary or fractional burial (Rajendran and Badam 1995).

The presence of the child's cranium along with a few adult human bones and animal bones within the same cist burial (T2) is enigmatic but suggests that the two individuals might be of the same family and died at more or less the same time. Such evidence is reported from the megaliths of Kanyathirtham in Cuddapah District, Andhra Pradesh (Walimbe *et al.* 1991). Limb bones of children were earlier discovered from the urn burials of Poredam near Chadayamangalam, Kollam District in 1989 and from Cheengalthadam near Malayalapuzha, Pathanamthitta District in 1990, both in south Kerala.

X-Ray Fluorescence Analysis

In the present study an attempt has been made to identify by X-Ray Fluorescence Analysis the nature of the gold and copper ornaments obtained from the Arippa cist burials. X-ray Fluorescence Spectrometry (XRF) is today a well established analytical technique for rapid, precise and simultaneous multi-elemental analysis. This method has found extensive application in the industrial, metallurgical, forensic, geochemical and archaeological research (Creagh 1992).

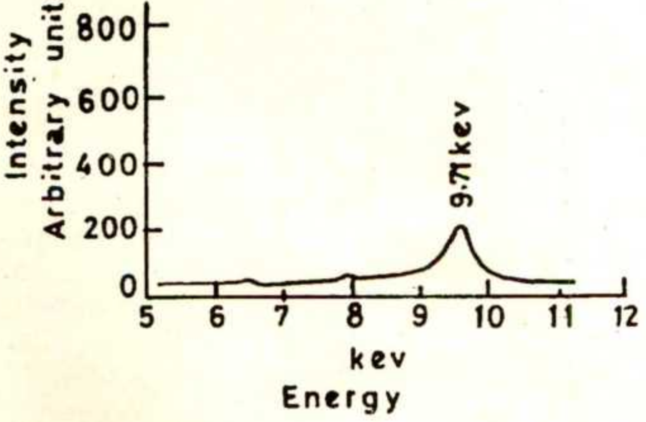

Fig. 5: X-ray Fluorescence spectra of the foil

Sample Preparation and Procedure

Wavelength Dispersive X-ray Fluorescence (WDXRF) has been used in the present study. The XRF unit used was a 1410 Phillips semi-automatic model. The major advantage of XRF is that it is chemically non-destructive so that the valuable specimens are preserved even after the analysis. X-rays penetrate only a few Å of the sample and as such the analysis data generated is restricted to this area. Hence it is necessary that the sample taken for X-ray analysis should be homogenous. The sample specimen was exposed to the X-rays from a Rhodium X-ray tube and the resulting secondary X-rays were scanned using a proportional counter.

Results and Discussion

The gold foil seen covering the slotted copper earrings obtained from the Arippa cist burials T1 and T2, show only the characteristic L μ X-ray of gold (Fig. 5). No other X-rays are evident indicating that the analyzed material is made of pure gold. This gold foil is of a uniform thickness measured by the Density Measurement method (Gettya *et al.* 1989). The foil is extremely thin i.e. only about 0.0075 mm, suggestive of the high metallurgical skill of the Megalithic people in making fine, pure gold ornaments.

The earring within the gold foil from T1 on irradiation showed characteristic X-rays of copper and iron 6.4 Kev of Fe K μ; 8.05 Kev of Cu K μ and 8.90 Kev of Cu K μ (Fig. 6; Table 1). This indicates more copper (Cu) and less iron (Fe), along with trace amounts of Si, V and Au. However, the analysis of the earrings obtained from T2 shows a

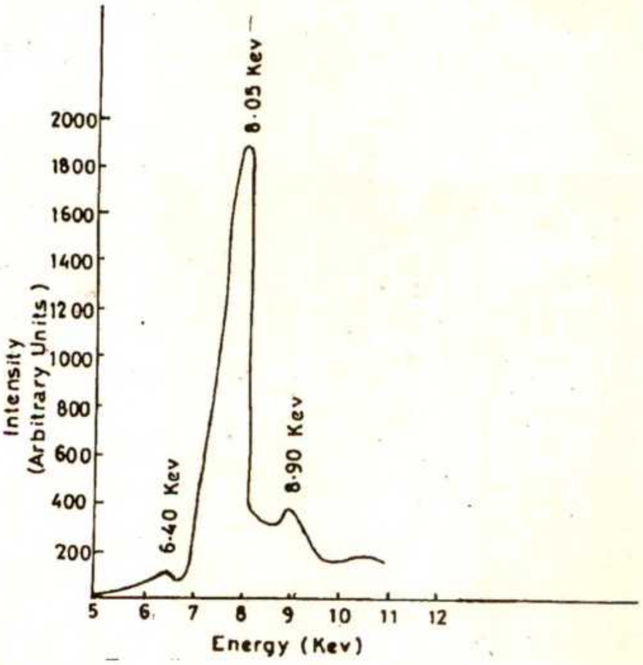

Fig. 6: X-ray Fluorescence spectra of the earring

Table 1: X-Ray Fluorescence intensities of different elements in the slotted earring

Trace Elements	X-Ray Intensity in Arbitary Units
Si	615
Cu	194372
Fe	7792
V	32
Au	1411

higher percentage of iron and less copper as compared to that from T1.

The copper bangle from T2 shows the characteristic X-rays of Fe and Cu along with traces of Si, V, Cr and Co (Table 2). It has relatively more Fe and less Cu than the body of the earrings seen in T2 (Fig. 7). This shows that the copper bangle and the two earrings seen in T2 contain more or less similar elements. Probably the raw material used for both types of ornaments in T2 were of impure copper without much pre-treatment and they might have been prepared either at the same place or by a uniform technology. The higher quality of the copper earring found in T1 perhaps indicates an advanced technology, probably prepared at a different place with better raw material.

X-ray fluorescence analysis has been used here mainly to detect which elements are present. No attempt has been made to quantify the elements as this would require sample preparation, thus destroying the integrity of the specimens. However, the intensities of the secondary X-rays generated would give an idea of the relative concentration of elements. Thus one can compare the intensities of iron and copper in both the samples and they are well recorded in Tables 1 and 2. In Table 1 there is a very high concentration of copper compared to iron while in Table 2 the concentration of iron is comparatively higher than that of copper.

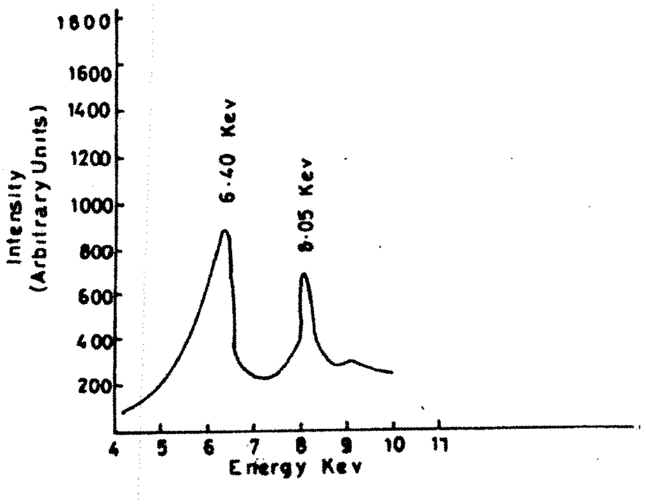

Fig. 7: X-ray Fluorescence spectra of the bangle

Table 2: X-Ray Fluorescence intensities and corresponding elements in the bangle

Trace Elements	X-Ray Intensity in Arbitary Units
Ag	Trace
V	170
Cr	120
Cu	64343
Co	76
Fe	878383
Si	1979

The analysis of the gold foil presents the same characteristics. The slotted copper earring from T1 contains more copper and less iron indicating an advanced metallurgical technology. The chemical composition of the copper bangle and the two earrings from T2 indicates the utilization of metal of an inferior quality, probably due to the lack of technological skill. The gold foil covering all the three copper earrings have identical characteristics indicating the use of a standardized technology. The compositional analysis of gold and copper ornaments from the Arippa Megalithic cist burials points to the fact that the Megalithic people of Kerala were probably able to exploit, extract and utilize various types of ores for different purposes. Further research is necessary both to learn more about the provenance of copper deposits in Kerala as well as the methods of ore extraction.

Acknowledgments

We are greatly indebted to Mr. R. Chandrasenan Pillai, Scientific Officer, V.S.S.C., Thiruvananthapuram for conducting the X-ray fluorescence analysis of the copper and gold ornaments, and to Prof. S.R. Prabhakaran Nair and Mr. Benny John of the Physics Department, Kerala University for their help in ascertaining the thickness of the gold foil.

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Significance of Remote Sensing for Geomorphic Mapping in Archaeological Investigations

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Abstract

Recent archaeological excavations at Majeru village in the Krishna delta have revealed cultural material pointing to the existence of a Satavahana port. This study highlights the importance of geomorphic mapping based on remote sensing in order to understand the palaeo-geographical setting of archaeological sites. This is essential for a proper interpretation of archaeological findings in the area and was undertaken for the Satavahana period towns of Majeru and Kothapatnam. The location of these Satavahana port sites shows changes in the coastline in the last 2.5 ka.

Introduction

Geomorphology, the systematic interpretation of landforms may be said to be a development of the present century. The advent of aerial photography and space imaging gave an added impetus to geomorphic studies. These remote sensing techniques provide true perspective images of the ground and facilitate the mapping of landforms based on their surficial expressions are primarily expressed as tonal variations in the image.

Landforms, once identified and correctly interpreted, have great application potential in the evaluation of natural resources such as soils, groundwater, minerals, etc., and in providing dependable data on the suitability or otherwise of an area for a given human economic activity. Thus, geomorphology, although primarily of interest to geologists and physical geographers, is gaining recognition as a necessary input in many other science and engineering disciplines whose basic requirement is an understanding terrain conditions. This in turn can be provided by geomorphic analysis of the natural materials, forms and processes.

Geomorphic studies have significant applications in archaeological investigations as well For instance, the mapping of buried river courses and natural levees (embankments) may lead to the identification of early settlements since ancient man preferred to stay close to water sources. Similarly, relict beach ridges which are the remnants of ancient strandlines along prograding coasts, also have the potential for revealing ancient port sites and associated human settlements.

This paper attempts to illustrate the importance of geomorphic studies based on remote sensing in archaeological research for locating ancient human settlements and more especially for the reconstruction of palaeo-geographical conditions that existed and perhaps influenced early cultures and economic activities. To demonstrate this, two case studies of known archaeological sites have been selected and by reconstructing the geomorphic history of the region, shown how the environmental conditions which influenced human existence at that time can be meaningfully interpreted

Archaeological Sites

The two sites selected for the present study are in coastal Andhra Pradesh, one located at Majeru village, Krishna District and the other near Kothapatnam, Nellore District.

Excavations conducted by the Andhra Pradesh State Archaeological Department near Majeru village located about 15 km northwest of Machilipatnam town have revealed indications of a historical settlement in the form of brick walls as remnants of dwelling units, wells lined with earthen-rings, pottery, a few coins of Roman origin, etc. (*The Hindu*, 3rd September 1993). The archaeologists have inferred that the site was a flourishing port of the Satavahana period (1st or 2nd century A.D.). It was also felt that though the site is at present about 20 km inland from the sea, it must have been on the coast at that time and that the sea has now receded to its present position during the last 2000 years.

A similar site near Kothapatnam, about 40 km southeast of Nellore, is now covered by sand dunes, and located about 1.5 km inland from the present coast. Ring wells, remnants of brick walls, besides Roman Rouletted Ware and Chinese stamped pottery were excavated (K.P. Rao: personal communication). It was inferred that this site was also a port town of the Satavahana period with international maritime trade links.

In both these cases, the archaeologists who have studied the sites have suggested that these were ports involved in international trade, but they lacked data on the geomorphic history of the region to prove it.

Geomorphic Setting of the Sites

Remote sensing studies based on the interpretation of aerial photographs and satellite imagery coupled with observations on the ground have helped to demarcate a variety of landforms around both Majeru and Kothapatnam. The landform maps prepared from these remote sensing analyses have not only thrown light on the geomorphic setting of these archaeological sites but also helped in the reconstruction of the palaeo-geographical conditions prevailing at the time these settlements flourished. Detailed accounts of the geomorphic analysis of these two ancient sites are given in the following sections.

Majeru

The photogeomorphic map of the Krishna delta (Nageswara Rao 1980), of which the Majeru region forms a part, clearly indicates a series of ancient beach ridges, ancient (buried) river courses and natural levees, apart from a host of other tropical deltaic features. Beach ridges represent former shorelines. The existence of a number of narrow linear sandy beach ridges lying up to about 35 km inland from, and parallel/subparallel to the present coast are indicative of the progradation of the shoreline in this region mainly due to delta building activity. Based on the disposition of various sets of these relict beach ridges, about 4 strandlines, each representing a major change in the coastal configuration either due to a change in the river mouth position or lowering of the sea level, have been surmised (Nageswara Rao and Vaidyanadhan 1978). A limited number of radiometric dates from different sections of the east coast including the Krishna delta, have led to the suggestion that the ages of the four strandlines are 6000, 3500, 2500, 1000 years B.P. (Krishna Rao *et al.* 1990).

A second important feature of the Krishna delta is the existence of a number of ancient abandoned river courses. It is known that rivers change their courses especially in their deltaic reaches (Meijerink 1971). A number of abandoned channels were mapped in the Krishna delta, and the various stages in the growth of the delta were reconstructed (Nageswara Rao and Vaidyanadhan 1978). This reconstruction was based on the inference of the loci of earlier river mouths from the disposition of these ancient channels with respect to the orientation of the beach ridges. Some of these ancient channels have also built natural levees akin to their present-day counterparts. Although most of these relict levees are washed out due to later fluvial erosion, some of their remnants are discernible even from the aerial photos as small patches and mounds. In the field, it can be seen that these remnant levee deposits are composed of laminated fine sand or silt. Natural levees are deposited during overbank floods (Tanner 1968). The finer fraction of the clastic material that is normally transported by streams in suspension may range from sand to coarse silt (Bates and Jackson 1987), silt (Bloom 1978), or silt and clay (Coleman 1968), depending upon the energy conditions of suspension. An earlier study (Nageswara Rao 1980) of the sediments of various geomorphic units on the Krishna delta has revealed (when plotted on Shepard's (1961) trilinear diagram) that the natural levee sediments are mainly silty in nature with 7 samples out of 18 falling in the sandy-silt category, 9 samples coming under the silt category and 2 samples falling in the clayey-silt category.

As can be seen in Figure 1, the Majeru archaeological site is located beneath one such remnant natural levee made up of very fine sand and silt. This levee was apparently built by one of the old distributary channels of the Krishna river, which was abandoned and later buried. This remnant levee is represented by a few small and low mounds rising about one metre above the surrounding deltaic plain used for cultivating paddy. An archaeological excavation yielded the Satavahana cultural material (discussed earlier), indicating the existence of an ancient port town.

The remnant natural levee contains archaeological remains and abuts an eroded beach ridge which is oriented in a general northeast-southwest direction (Fig. 1) near Machilipatnam town. Settlements in deltaic regions, such as the study area are located either on beach ridges or natural levees which offer slightly higher ground, important in these otherwise low-lying, flood-prone deltaic plains For example, the location of the present settlements such as Machilipatnam, Challapalli and Koduru as shown in the map (Fig 1), indicate this phenomenon. At Majeru

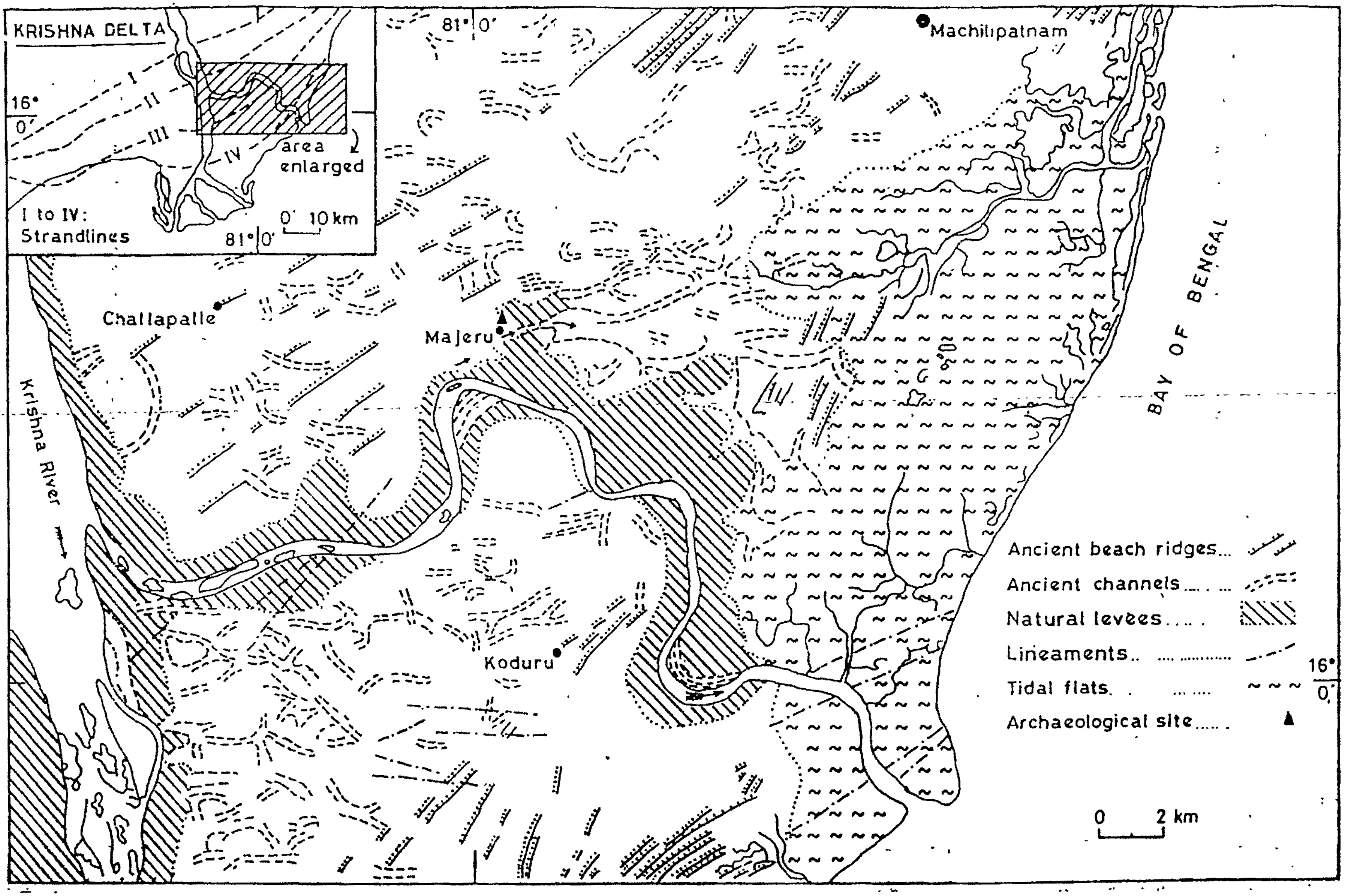

Fig. 1: Geomorphic features of the Majeru area in the Krishna delta as interpreted from aerial photographs and satellite imagery The location map (inset) of the area shows the four strandlines inferred in the region, each indicating a major change in coastal configuration during the Holocene

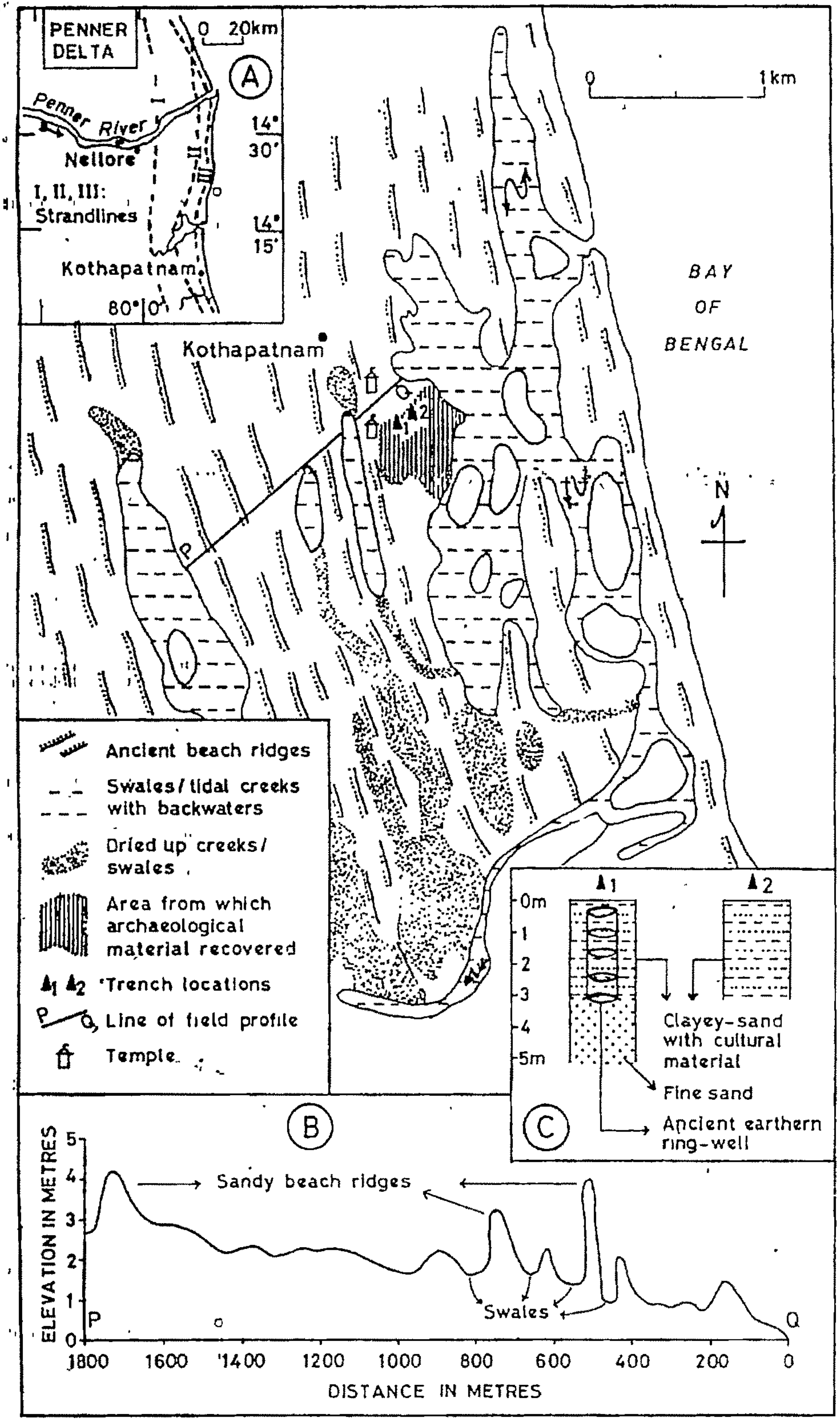

Fig. 2: Geomorphic features in the Kothapatnam area to the south of the Penner delta as interpreted from the IRS 1A LISS II imagery (FCC on 1:125000 scale dated 21-01-1990). The location map of the area Inset A indicates the 3 strandlines shown as broken lines and designated as I, II, and III that are inferred in the region, each representing a major change in the coastal configuration during the Holocene Inset B is a profile of the sandy beach ridge-and-swale topography along the P-Q line marked in the main map. Inset C shows shallow subsurface layers and an ancient well exposed in the trench sections

ancient wells are found within the premises of the present households near the ancient site, and people still draw water from these wells for their domestic consumption. Apparently, the wells are dug into the beach ridges.

In the light of this geomorphic evidence (including the ages of the beach ridges), the palaeo-geographical setting of the ancient port town at Majeru can be interpreted in the following way:

The age of the beach ridge which belongs to the third strandline near the site is dated around 2500 B.P. The age of the port is about 1900 years B.P. based on the archaeological data (Satavahana period) and is consistent with an age of 2500 B.P. for the beach ridge, since the human habitation must have come into existence well after this beach ridge was formed. It is therefore likely that the sea was close to this particular beach ridge when the settlement was on it. Later, when the sea receded due to progradation of the coast, the settlement might have been abandoned as it was no longer in a favorable position for a port town. In addition, one of the distributaries of the Krishna river started flowing close to this site along the course shown in Figure 1 (as an abandoned channel with its flow direction indicated by arrows in the map beginning just south of Majeru). This distributary deposited levees over most of the settlement area burying, in the process, the abandoned houses, wells, etc., excavated only recently. The frequent floods from the river and natural levee deposition might have forced the dwellers to abandon the site for a safer place.

Kothapatnam

The excavated site near Kothapatnam village, located south of the Penner delta is about 1.5 km inland from the present shoreline and within 500 m from a tidal channel. Extensive excavations in the sand dunes have revealed the cultural material mentioned above. This is considered by archaeologists to be one of the largest port towns of its class found in this region.

A study of the satellite imagery covering the region in the vicinity of Kothapatnam village has revealed a number of sandy beach ridges lying almost parallel to the present shoreline. These ridges are separated from one another by inter-ridge depressions (swales), some of which are occupied by tidal channels (either active or filled-in) and backwaters (Fig. 2).

A cross-country profile based on an abney level survey conducted in the area has revealed the elevations of these ridges which rise up to 4 m above the present high water level (Fig. 2, inset B, the location of the profile is shown by the P-Q line in the main map). It may be noted that the high tide level here is taken from the edge of the tidal channel at the point Q in the map. Field observations have indicated that the upper 3m of the deposit contains the cultural material (Fig. 2, inset C), and constitutes fine sands mixed with black clay. This layer is underlain by a predominantly fine sand deposit, typical of beach ridge material commonly occurring in these parts.

The particular beach ridge on which the archaeological site is located belongs to the 3rd strandline as does the Majeru site. The age of this 3rd strandline which occurs more or less consistently along most of the 2300 km long east coast of India is believed to be about 2500 years old (Nageswara Rao and Sadakata 1993).

The geomorphic evidence coupled with the data on the ages of the strandlines confirms the archaeological inference regarding the age of the Kothapatnam site which is stated to belong to the Satavahana period i.e. about 1900 B.P. It may be surmised that after the deposition of the beach ridge about 2500 years B.P., the port town was built on it about 2000 years B.P. as it was close to the sea and hence suitable for navigation. The best possible condition was the presence of a tidal inlet which provided a safe passage to and from the sea and anchorage for boats. Subsequent to the progradation of the coast, it is likely that not only did the site become distant from the sea but the tidal channel was also possibly silted up preventing the movement of the boats/ships and leading to the abandonment of the site. Further, the cultural remains of the settlements were buried under the subsequent clayey tidal deposits. The occurrence of black clay in the upper 3 m thick sandy beach ridge deposit is indicative of tidal clay. The tone of the satellite image is also typical of tidal clay.

Conclusions

The archaeological remains both at Majeru and Kothapatnam have yielded similar cultural materials such as bricks, wells lined with earthen rings, pottery, coins, etc., based on which the two independent archaeological studies have concluded that both were port towns belonging to the same period i.e. the 1st or 2nd century A.D.

Geomorphic analysis through remote sensing of the areas around the sites have conclusively indicated that these sites are located on beach ridges, thereby justifying the archaeologists' inferences that the sites were port towns near the sea shore at that point of time. The landform study explains how these sites which are far inland from the sea shore today, could once have been used as sea ports.

In addition, the location of these two sites on the third strandline reveals that these two settlements were contemporaneous, which is also corroborated by the similarity of the cultural material.

Perhaps, the most important conclusion that can be drawn from this study is that geomorphic analyses based on remote sensing are definitely helpful in archaeological investigations and that a geoarchaeological approach aided by remote sensing techniques is essential for the reconstruction of the palaeo-environment and the understanding of cultural development.

Acknowledgement

K.S. Rao is grateful to the Council of Scientific and Industrial Research (CSIR), New Delhi for awarding him a Senior Research Fellowship.

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Onshore and Nearshore Explorations along the Maharashtra Coast: with a View to Locating Ancient Ports and Submerged Sites

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Abstract

Coastal explorations were carried out along the west coast of India at Elephanta Island, Malvan, Vijaydurg, Sopara and Chaul. A number of lead and copper coins as well as pottery of different cultural periods were found. Onshore explorations at Malvan and Vijaydurg yielded stone anchors of the Historical period, the first of their kind to be found in this region. The purpose of the submerged stone structure off Vijaydurg appears to have been damage to enemy ships or protect the fort from wave and current action. Other discoveries as well as offshore explorations are of importance in the reconstruction of the maritime history of India.

Introduction

Marine archaeological research seeks to reconstruct the history of shipping, maritime trade and cultural migrations by exploring and excavating defunct and submerged ports as well as sunken ships. A systematic attempt has been made by the National Institute of Oceanography (NIO) to explore and study the ancient ports and their locations all along the coast of India.

The present paper discusses the results of coastal explorations at Elephanta Island, Malvan, Vijaydurg, Sopara and Chaul (Fig. 1). These sites were important ports located on the west coast of India. Offshore explorations were only carried out around Vijaydurg. Data on shipwrecks were also collected from local sources. Remains of ancient port installations and other coastal structures were also surveyed.

Elephanta Island

Elephanta Island, 7 km in circumference, is situated about 10 km off the coast of Mumbai. It is locally known as Gharapuri and comprises the three villages of Rajbandar, Morabandar and Shetbandar. Elephanta Island was also a port between the 1st century B.C. and the 16th century A.D. The earliest port during the Satavahana period was Morabandar. Rajbandar served as a port during the Roman period and Shetbandar during the Portuguese period. The Aihole inscription states that Pulakesin II, the Early Chalukya ruler invaded the island, vanquished the Konkan Mauryas and reduced Puri (Gharapuri) after attacking it with hundreds of ships (Kielhorn 1900-01). This Gharapuri might have been the capital of the Mauryas. After the Chalukyas, the island passed into the hands of the Rashtrakutas (8th century A.D.) and subsequently to the Chalukyas of Kalyana (10th century A.D.), the Yadavas, the Muslim invaders, the Portuguese, the Marathas and the British (Sastri 1934).

Rajbandar

Previous Work

While quarrying earth at Rajbandar to construct a water reservoir in 1973 the Public Health Department, Government of Maharashtra, exposed a brick structure which was later identified by the Archaeological Survey of India as a jetty-cum-wharf. The wharf (4 m in height and 15 m in length) has an outer face sloping inward (Rao 1983). Silver Kashatrapa and Roman coins dating from the 1st-4th century A.D. as well as small copper coins known as *Kakinis* and *Karshapanas* of the 1st century B.C. to 1st century A.D. were also found at the site. Amphorae fragments, Red Polished Ware (RPW), copper coins (*Kakinis*), etc. recovered from the earliest level suggest that

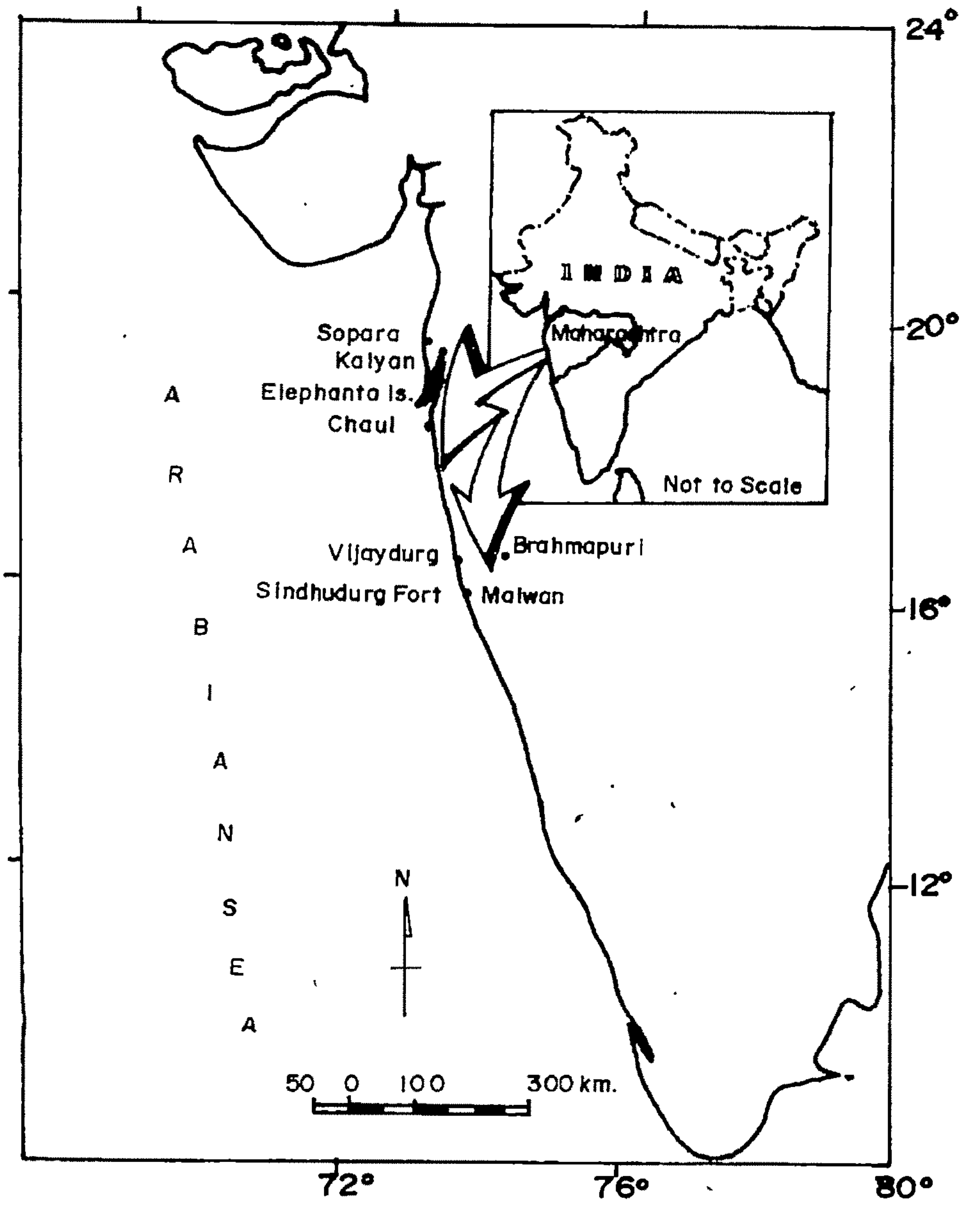

Fig. 1: Map showing the sites explored on the coast of Maharashtra

Rajbandar was a port with trade contacts with the Roman world (Rao 1987). It is believed that the wharf was in use from the 1st century B.C. to the 7th century A.D. (Visweswariah 1985).

Present Explorations

The newly constructed jetty opposite Rajbandar has destroyed the ancient remains and the whole area is covered with stone chips making it difficult to trace the pottery and other antiquities of the historical period. A few Chinese sherds, a carnelian bead and copper coins were collected from the vicinity. Rolled and unrolled pottery was noticed respectively within the nearshore area and in the sections.

Morabandar

Morabandar, which name probably derives from port of the Mauryas of Konkan, is a small hamlet on the northeastern side of Elephanta Island. A number of circular and square copper coins were collected from Morabandar. On two lead coins on the obverse a three peaked hill is visible and a wheel is seen on the reverse. On one of the copper coins a Brahmi character read as **Ya** is also visible. The section facing the sea is hardly 5 m above the high water line. Section scrapings yielded pottery which included a bowl, dish, jar, and plates of Red Ware and coins of different periods. In the intertidal zone rolled pottery and fragments of carnelian nodules were found. While crossing over the

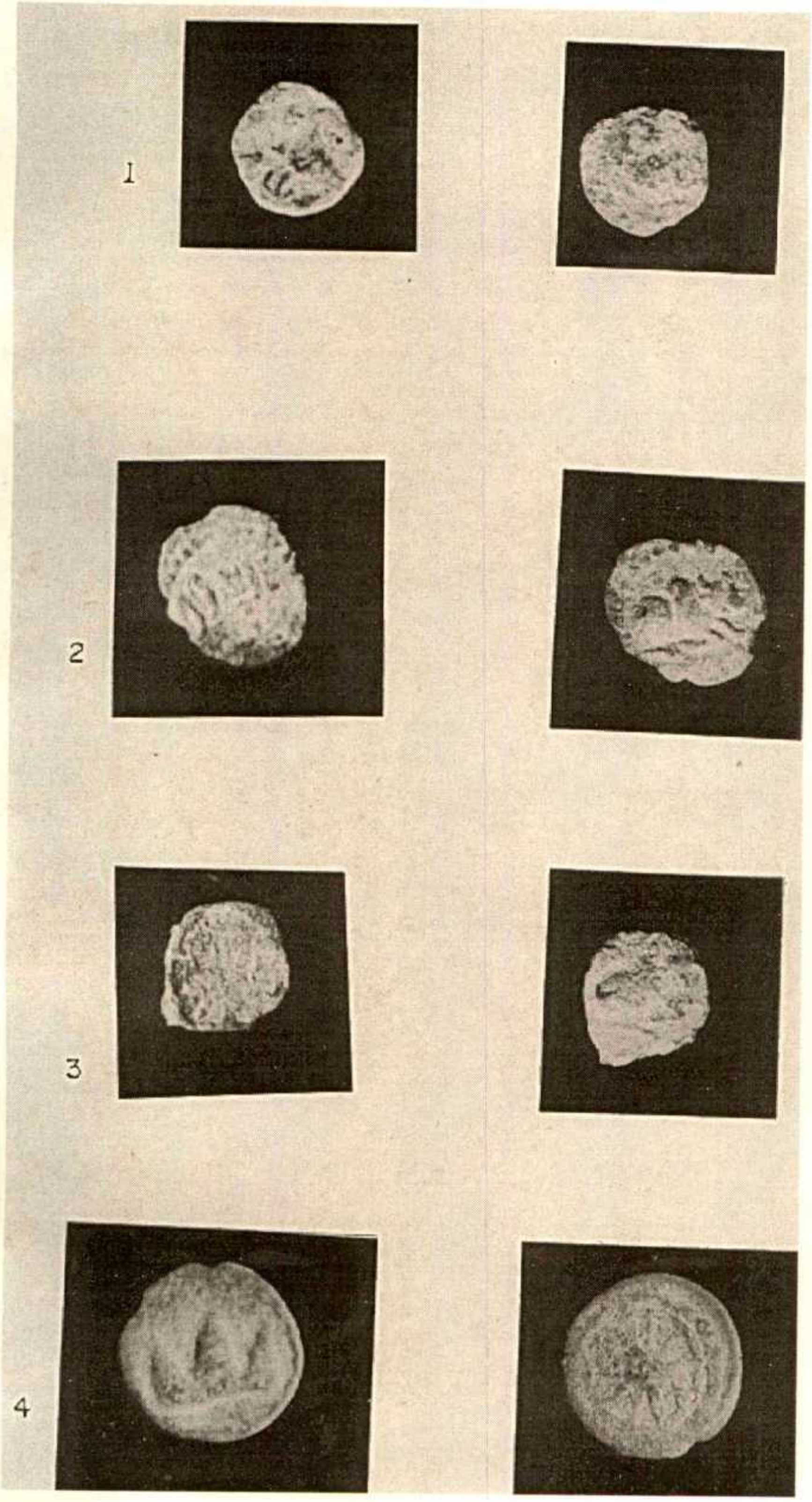

Fig. 2: Copper and lead coins from Elephanta Island

hillock between Morabandar and Shetbandar some brick and stone structures were also noticed on the surface. The brick structure extends towards the sea and is more than 15 m in length. A stone pestle was found in the vicinity (Rao *et al.* in press). Since a large quantity of coins and numerous structural remains as well as pottery were found at Morabandar it is presumed that this site might have been a habitational area during the Roman period while Rajbandar certainly was a port.

Shetbandar

During the Portuguese period Shetbandar served as a port. Large sized bricks are seen scattered in the intertidal zone along with potsherds of RPW. On the way to Morabandar from Shetbandar, a rock-cut well 2.5 m in diameter was also noticed. In a rain gully at Shetbandar a brick wall was seen (approximately 15-20 m in length, 1 m high) made with bricks (30x20x7 cm). Below the wall was a 1 m thick deposit of loose clay underlain by another thick deposit consisting of miniature bowls, spouts and jars. They are thin in section, unpainted and ill-fired. The brick wall appears to be of the Gupta period while the pottery may belong to the pre-Gupta period.

The presence of a large number of bricks of the Early Historical period in the intertidal zone suggest that the township once extended further towards the sea.

Coins from Elephanta Island

At Elephanta Island 24 coins were collected: 15 are of copper and the remaining 9 are of lead. The earliest coins may be dated to the 2nd century A.D. on the basis of the Brahmi **Ya** found on a coin perhaps issued by the Satavahanas. Two of the copper coins are of Sri Krishnaraja of the Kalachuri dynasty (A.D. 550-575). Similar coins had earlier been reported from Morabandar by Gokhale (1976) and others (Rajgor and Lad 1992). A description of four coins (Fig. 2) of which the first three are of copper and the fourth one of lead are given below:

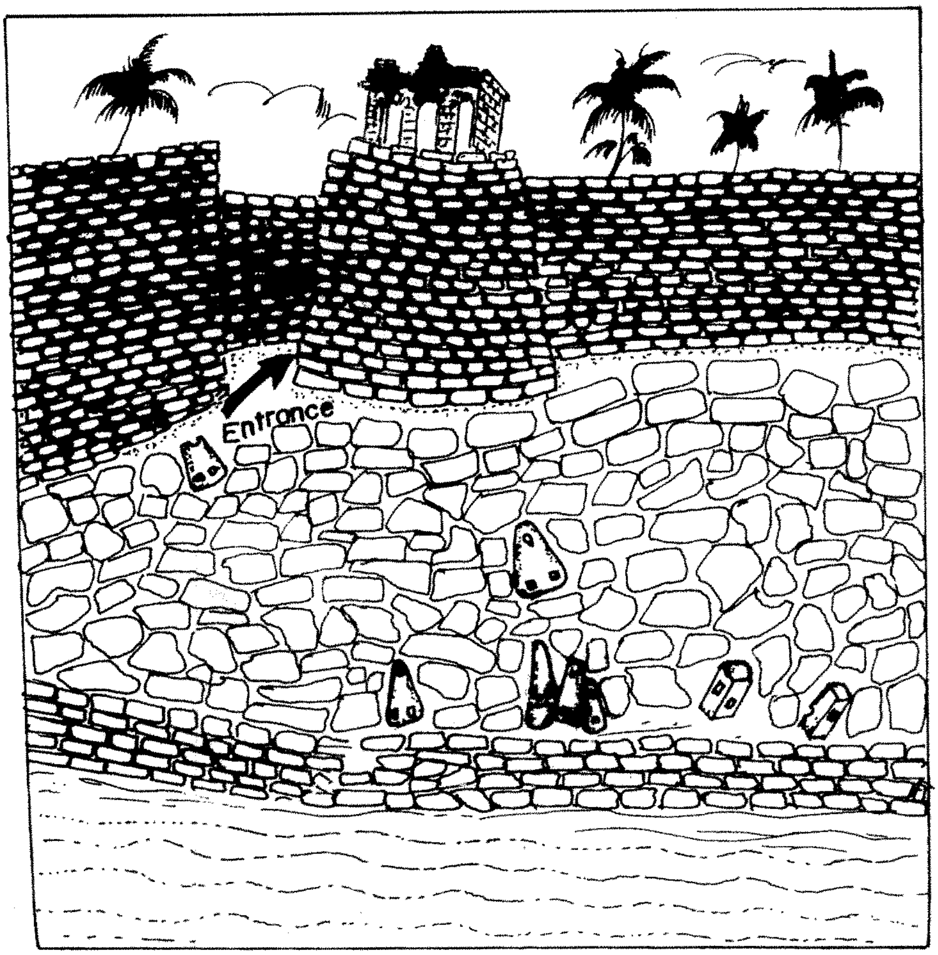

Fig. 3: Location of stone anchors on the platform of Sindhudurg Fort

1. Obverse: four Brahmi words are visible but only one character can be read as **Ya**

   Reverse: heavily encrusted

2. Obverse: Sri Krishnaraja within dotted border, below an altar-like hollow symbol

   Reverse: Couchant Nandi facing left

3. Obverse: Sri Krishnaraja within dotted border

   Reverse: Couchant Nandi facing left

4. Obverse: a three peaked hill

   Reverse: wheel with ten spokes within dotted circle

Malvan

Malvan is in Sindhudurg District (previously Ratnagiri). Malvan (Aurannoboas) and Vijaydurg (Byzantine) were minor ports in ancient times. Schoff (1974) refers to Aurannoboas which McCrindle (1879) identified with modern Malvan. These minor ports had direct contact with Sopara and Kalyan. Shivaji, the great Maratha king constructed several coastal forts including the one at Sindhudurg to protect his vessels and as a stronghold in adversity. Sindhudurg Fort is constructed on a low island called Kurte, about 1.6 km offshore from Malvan. The western side of the outer wall has been damaged as a result of wave action. Another small ruined fort called Padamgad, opposite Sindhudurg, was built on a smaller island and served as a shipyard for Shivaji (Apte 1973). Padamgad Fort is now connected with the mainland by the development of a neck of sand.

Present Explorations

Exploration of the forts of Sindhudurg and Padamgad revealed a number of triangular and grapnel-type stone anchors: 3 of the former and 5 of the latter type were noticed at Sindhudurg Fort (Fig. 3). These triangular anchors and three of the grapnel-type anchors have been used in the construction of the platform of the jetty of the Sindhudurg Fort while the other two grapnel-type anchors are used as mooring bits (Fig. 4). Another grapnel type stone anchor was noticed at the entrance of the Padamgad Fort (Fig. 5). All these weathered anchors are made of locally available laterite and sandstone and provide information on the maritime history of the region. They are the first of their type to be found around Malvan.

Similar types of anchors have been found in the waters around Dwarka and Prabhas-Patan-Somnath (Rao *et al.* 1992). The size, age, shape and material of these anchors differ from region to region. It seems that they had been in use prior to Shivaji's construction of the fort. During the 17th century iron anchors were used extensively and stone anchors rarely. Thus, it is very likely that stone anchors were used for paving, mooring and various other purposes.

The archaeological excavations at Brahmapuri, on the banks of the river Panchaganga near Kolhapur yielded Satavahana coins and a statuette of Poseidon, the Roman sea god along with a number of bronze vessels of Roman origin thus providing evidence of commercial contact with the Mediterranean world from 200 B.C. to 200 A.D. It is very likely that the trading community of Brahmapuri contributed to the spread of *Buddhi*sm on this part of the west coast (Ghosh 1989). Satavahana coins were also found at locations closer to Malvan, however, sites near Sindhudurg Fort have not yielded pre-Satavahana antiquities. It appears that after the decline of the Satavahanas, Malvan and Vijaydurg lost their glory until they were absorbed into the kingdom of Shivaji.

Vijaydurg

The Early Historic port of Vijaydurg is situated on the southern bank of the river Vaghotan in the Devgad taluka of Sindhudurg District and was referred to as Byzanteion and Byzantine by Ptolemy (McCrindle 1885) and Periplus (Schoff 1974) in the 1st and 2nd century A.D. Vijaydurg again came into the limelight during the rule of Shivaji,

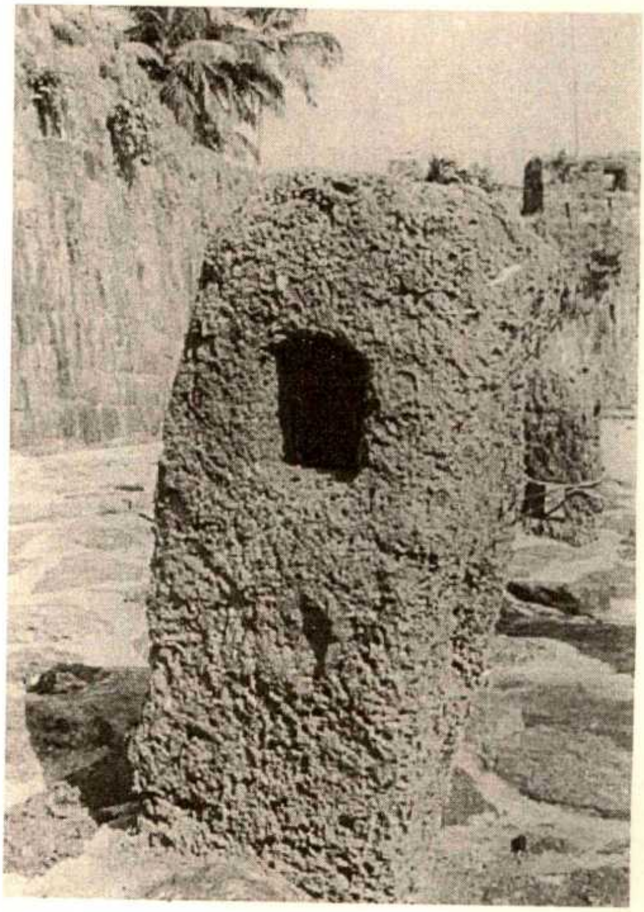

Fig. 4: Grapnel-type stone anchor used as a mooring bit at the entrance of Sindhudurg Fort

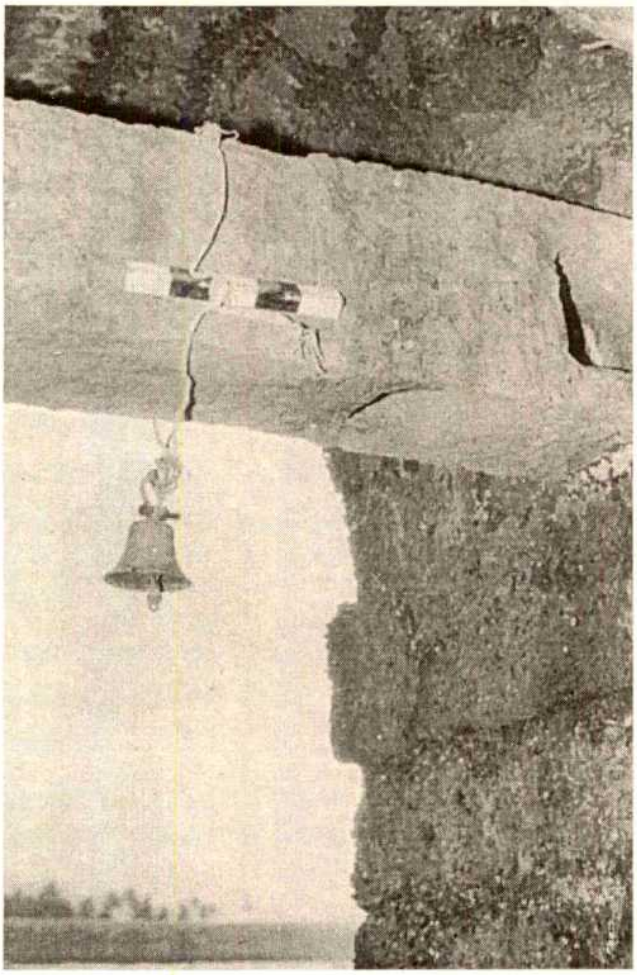

Fig. 5: Grapnel-type stone anchor used as a lintel at the entrance of Padamgad Fort

who made Vijaydurg the naval base of the Maratha kingdom. There were frequent naval battles between Europeans and Maratha kings and a number of ships were burnt and sunk in the Vijaydurg waters due to exchange of fire (Apte 1973).

Present Exporations

Explorations and excavations were carried out in the nearshore area of Vijaydurg in December 1995 (National Institute of Oceanography 1996). Diving as well as airlift operations with the help of metal detectors and the Global Positioning System (GPS) were carrried out in Vaghotan creek and on the western side of Vijaydurg Fort at a depth of 8 to 10 m. Underwater explorations (Fig. 6) on the western side of the fort (about 100 m seaward) revealed a huge linear stone structure built of irregular stone blocks, trending EW and with the offshore end veering to the south. This structure is 122 m long, 7 m wide and 3 m high. It is believed that it belongs to the Maratha period and was probably constructed to cause damage to enemy ships as well as to protect the fort from wave and current action. The underwater probe and metal detector survey were carried out at various locations inside the creek followed by airlifting which revealed coal, shale, slag and medieval pottery at a depth of 2.5 m on the sea bed. Other finds include the two iron sling balls, indigenous pottery, a few sherds of Chinese ceramic, chalcedony nodules and the wooden logs of wrecked ships.

Onshore explorations in the area about 3 km from Vijaydurg revealed a tidal dockyard (*godi*) on the bank of the river Vaghotan (Fig. 7). This dockyard was built by the Maratha admiral Kanhoji Angre in the 17th century A.D. This dock was renovated by Anand Rao Dhulup who also increased the landing capacity. The dimnensions of the dock are 110 x 75 m and it had a capacity to hold ships of 500 tonnes. The entrance of the dock is 7 m wide at the base and 12 m at the top. The southern and eastern sides are cut out of natural rock while the third side is a dry masonary construction.

In addition, a number of stone anchors were also located in the adjoining area of the dockyard (Fig. 8). It appears that these anchors were used as mooring bits when the dock was in use. Eight grapnel-type stone anchors were also discovered to have been used as a lintel in the parapet wall of the second fortification of Vijaydurg Fort. The anchors are generally in good condition, made out of locally available sandstone. A cannon stand was also noticed near the third fortification wall of the fort.

Sopara

Sopara, presently known as Nala Sopara (Vasai taluka, Thane District) is about 58 km north of Mumbai. Nala Sopara is accepted by scholars as the Suparaka or Supparak of ancient India and was a busy trade centre and an important seat of *Buddhi*sm. It was also one of the administrative units under the Satavahanas and is mentioned in the inscriptions of Karle, Nashik, Naneghat and Kanheri (Ray 1994).

Previous Work

The stupa site of Sopara locally known as Baruda Rajacha Killa was excavated by Bhagwanlal Indraji in 1882 and yielded a fragment of the VIII Rock Edict of Asoka along with a large stone coffer, jewellery, a copper casket and seven Buddha images and a Maitreya image (Inderji 1882). The site was re-excavated by M.M.Qureshi of the Archaeological Survey of India in 1939-40, when several stone lintels and two small stupas were found on the south side of the main stupa in addition to a few sherds of plain glazed ware of the Muslim period (Desai 1981-84). Anwar Munshi (1972) found a number of Satavahana lead coins at Sopara.

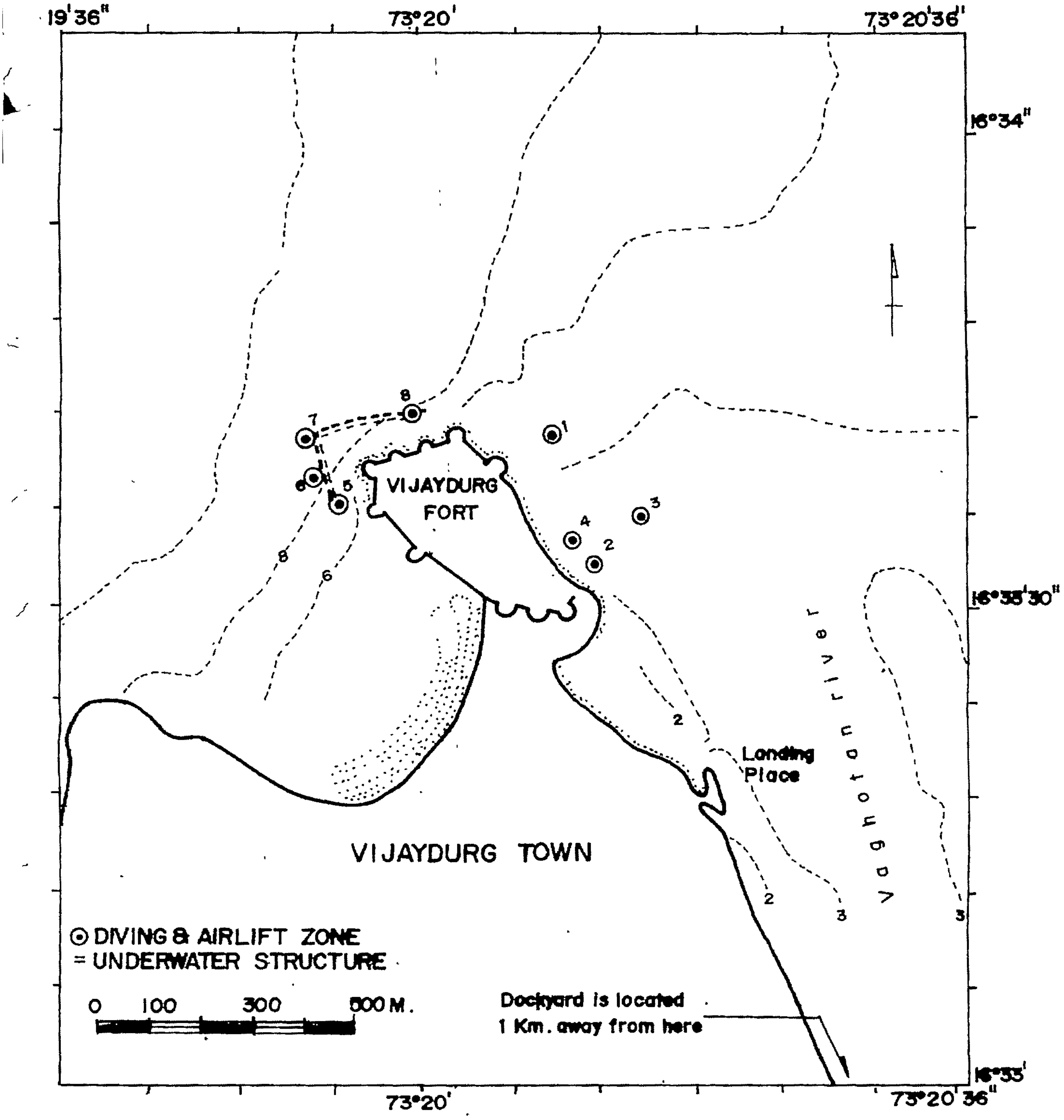

Fig. 6: Figure showing the diving, airlift operation and underwater structure in the nearshore Vijaydurg waters

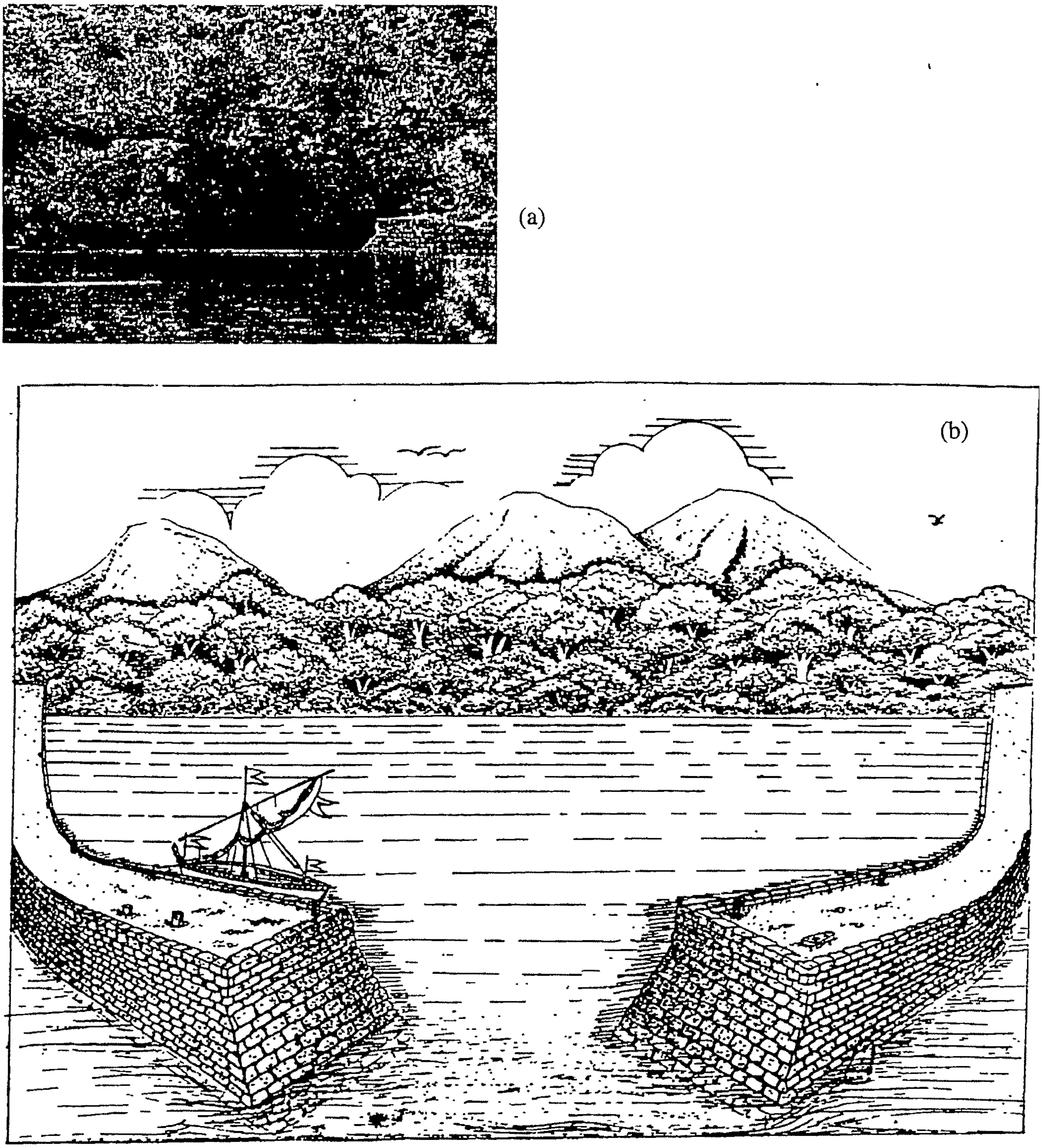

Fig. 7: Vijaydurg: (a) general view of the dockyard, (b) artistic view of the dockyard

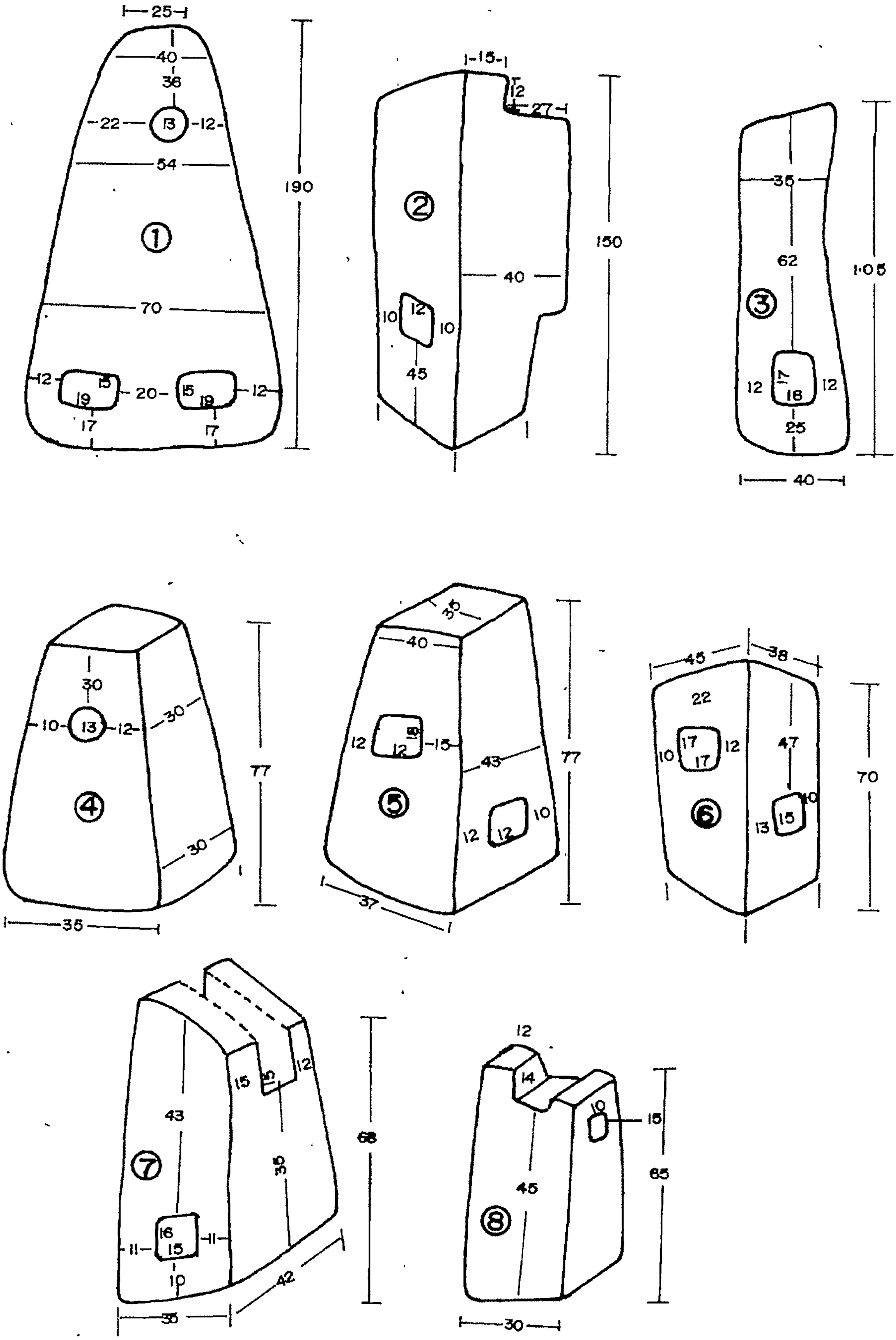

Fig. 8: Vijaydurg: stone anchors found in the adjoining area of the dockyard

Present Exploration

The ancient habitation site lies 2 km away from the stupa which overlooks the dry creek on the south and on the east opens to Thane creek. A large quantity of Islamic Glazed Ware, Black and Red Ware (BRW) and RPW were found at the site. It seems that during the Early Historical period Sopara was located on the mainland facing Agashi island on the north and Bassein to the south. The backwaters between the mainland and the island were suitable for the movement and anchorage of ships. Gas and Nirmal villages were once part of the creek. A number of tanks and architectural remains are noticed in the areas adjoining these villages. All the ancient relics were found in the area between the stupa and the creek. Up to the 19th century this creek was navigable and ships of 20 tonnes used to ply here. The significance of the architectural pieces becomes more important when the surface findings are taken into account. The area around Bhatela pond is a landing place or *bunder*, where even remains of a Portuguese jetty and customs house are seen. Exploration (1994) in the adjoining area has yielded RPW and Glazed Ware. The evidence is further corroborated by a joint excavation in 1993 carried out by the Archaeological Survey of India and the British Academy, Hyderabad where antiquities of the Early Historical period (Satavahana and Kashatrapa period) — lead and copper coins, semi-precious stone beads, small fragments of Northern Black Polished Ware (NBPW), amphorae pieces and Islamic Blue Glazed ware were discovered. An earthen wall and a fourteen coarse stone wall with varying sizes of stone blocks were also encountered during this excavation (Howell 1994).

It is clearly evident from the archaeological and literary sources that Sopara was the main entrepot dating from the pre-Asokan period up to the 3rd century A.D. and again from 9th to 13th century A.D. There is no evidence of cultural remains from 4th to 9th century and it seems that during this period Sopara had lost its importance (Dhavalikar 1988). Ghate (1996) shows that the main cause for the decline of the ancient port of Sopara was due to the effect of siltation caused by a rise in sea level. Further nearshore and offshore marine archaeological exploration and excavation would be helpful to ascertain the extent of the ancient port city.

Chaul

Chaul, also known as Ceul is situated on the right bank of the Kundalika river (Alibagh taluka, Raigarh District). In Early Historical times Chaul was an important port on the west coast of India. The trade and commerce of Chaul is known from archaeological evidence, accounts of travellers and records of the foreign rulers. Chaul also had hinterland contacts with Nashik and Junnar. The economy of ancient Maharashtra was sound and stable in the Early Historical period because of the maritime trade from Kalyan, Sopara, Chaul and Dabhol. Chaul also had trade contacts with Alexandria for the export of rice and cloth as well as sugar to Egypt. Merchants also used to collect spices and textiles from Chaul (Kenny 1994).

Present Explorations

Structural remains of the ancient period were not traceable in the Chaul region Presently, shrines of the god *Hinglaj* and a number of *Buddhi*st caves can be seen on a hillock which is very close to Chaul village. These caves are now in a dilapidated condition. Some hero-stones of the later medieval period were also noticed in the foothill area. The ancient channel and other relics of the old port town of Chaul can be seen from the top of the hill. It seems that this hillock served as a lighthouse in ancient times (Tripathi 1992). The ancient approach road to the old Chaul port town passed near *hamam khana*, which is now covered with bushes. A large quantity of Chinese pottery which can be dated between 1400 and 1700 A.D., along with indigenous glazed ware were also noticed along the road. The pottery is decorated in blue and grey with floral and faunal designs and the main types are dishes, platters and cups.

The dilapidated Portuguese fort of Revdanda near Chaul is known as Agar Fort. In the recent past a sea wall has been constructed to check further damage to the fort. Chinese and indigenous pottery and a few glass bangles were also noticed in the debris of the fort wall.

Conclusions

Recent onshore and offshore explorations show that during the Early Historical period Elephanta Island, Sopara and Chaul were important ports of Maharashtra. The underwater explorations off Morabandar, Shetbandar and Sopara should reveal antiquities of the historical period. Rapid siltation accounted for the decline of Sopara, while erosion and anarchy might have been the reasons for abandoning the ports on Elephanta Island. Archaeological finds, e.g. Satavanhana coins from the Malvan region together with the description in the *Periplus* of Malvan (Aurannoboas), suggests that these stone anchors belong to the Early Historic period (3rd century B.C. to 2nd century A.D.). The subsequent reuse of these stone anchors for various purposes at Sindhudurg and Vijaydurg forts, when combined with the results of underwater exploration indicate that these places were important naval centres of the Maratha period. An intensive nearshore and offshore exploration at strategic locations will prove to be of value for the reconstruction of the maritime history of India.

Acknowledgements

The authors are grateful to the Director, National Institute of Oceanography, Goa for providing the necessary facilities during exploration, to Shri. K.H. Vora, Scientist-in-

Charge and Dr. S.R. Rao, Advisor, Marine Archaeology Centre (NIO) for various suggestions. We thank Cmdr. A.V. Gupchup, Master Mariner of Mumbai Port Trust for providing information on Vijaydurg. Our special thanks to Shri. V. Gowthaman for preparing the drawing of the dockyard. We are indebted to our colleagues including Shri. M.K. Saxena for their continuing support and encouragement throughout field trips, to Shri. S.B. Chitari for preparing the figures and to Shri. S.N. Bandodkar and Shri. Sheikh Ali Karim for the photographs.

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Living Pre-Rigvedic and Early Rigvedic Traditions in the Himalayas

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Abstract

This is an account of some unique living traditions of the pre-Rigvedic and early Rigvedic period from the western and northwestern Himalayan terrain of the Saptsindhus. The traditions are today embodied in very old rituals and fairs — *Buddhi Diyaudi, Jhiru, Bishu* and *Bhunda.* Strictly speaking, these are not fairs nor are they folk performances like the Ram Leela or the Ras Leela. They can only be understood and interpreted with the help of Rigvedic references, which in turn help to elucidate Rigvedic allusions, provide visual confirmation of some of its events and establish their historicity.

Introduction

The history of a people is a story of their culture. In the Indian context, the Vedas form the source material of its culture and the Himalayas the most magnificent component of this heritage. At some point in time the people of the western and the northwestern Himalayan region lost contact with the Vedas and Vedic culture and were branded *pisachas* and *virshals*, i.e. barbarians and outcasts. Their isolation however, is a boon to Indian history, for they have preserved the unique traditions of the past in the form of fairs and rituals which can well be described as the living relics of India's remotest past.

Buddhi Diyaudi: The Indra-Vritra Conflict

The name itself explains its nature. *Buddhi* means old, ancient and the term *diyaudi* in common parlance means a violent clash. The fair — the *Vritrasure Mela* — relates to an ancient violent conflict, the saga of Vritra, the Asura (demon).

The bitter conflict between Indra and Vritra is the earliest and the single most important event mentioned in the Rigveda. Almost every sage who composed hymns catalogued the exploits of Indra, extolled his success in annihilating Vritra and releasing the waters held back by him. They say that Vritra, the *Ahi* (dragon) was slain a long time ago, and the legend came down to them from the ancients (RV vii.56.23; vi.21.3; iv.19.9; iii.32.13). This feat of Indra is spoken of as his most outstanding achievement (RV I.32.14) and elevated him to the status of a mighty deva (god) (RV ii.32.10; i.32.ff; x.50.1). The epithets *Vritrahun, Vritraghan, Vritrahunta* and *Vritraha* are found in several hymns (RV I.80.3; I.81.1.; I.108.3; I.175.5). It is only after Vritra is vanquished that Indra becomes immortal (RV x.50.5), the unrivalled victor (RV v.42.6), the invincible (RV I.11.2; viii. 38.2), and the great Creator (RV ii.16.2; x.144.1). He is ancient, strong, energetic, the mighty weilder of Thunder (RV vi.32.1) whom the gods installed as their champion to win battles (RV I.102.9; vi.17.8) and thus assigned him the first place among them (RV viii. 16.3; viii. 63.12; x.66.1; x.76.4).

Vritra is *Prathma Ahi* (the first among the *Ahis*) who also considers himself invulnerable and immortal (RV iii.37.7; ii.11.2), who creates darkness and is an obstructer (RV I.54.10). He is Danava (RV v.32.1; v.29.4; v.32.7; ii.12.1; ii.11.10), Dasa and Dasyu (RV I.32.4; I.33.7,9; ii.11.18; ii.20.7; vi. 32.1; v.32.3; v.33.4), and Mridhravacha (RV v.32.8). He is a demon and an Asura also.

In the Himalayan performances, Indra (though not named as such) is a human being, a leader, a commander and a king. Vritra, under his own name, is a demon, a divine being, an individual simple at heart and an easy prey to perfidy, a deity worthy of worship and a mighty leader who almost succeeds in overwhelming his great rival and securing the fire for his people. But it is as an *Ahi*, a fire-spitting dragon and a satiated serpent that he plays his role here. *Ahi* is the most favoured epithet used by the Vedic poets. The Rigveda uses this synonym as many as 47 times.

Buddhi Diyaudi is a vivid enactment of a series of events and might at one time have been an important ritual performed or enacted on the eve of the onset of winter, probably to seek a safe passage through the harsh Himalayan winter months. The clash between Indra and Vritra, originally perhaps leaders of two rival tribes or contenders for dominance within the same group and for possession of fire and water, the two elements which ultimately determine power and supremacy. Fire was in the possession of its discoverers, projected by the Rigveda as Deva or Indra people, while water was controlled by their rival Vritra and his followers — Danava, Daitya, Asura and Raksas, terms identical to those used for the *Buddhi Diyaudi* contestants. Indra has his own people the Garhiyas, the lord of Garhs which correspond to the Marut ganas and as such the Maruts and the Vritra side consists of the Danava, Daitya and Raksas, all of whom are historical people.

The Nightshow: the Struggle for Fire

The Rigveda tells of water being the main bone of contention and only makes oblique references to a tussle for the possession of fire. The three day *Diyaudi* beginning at dusk on the amavasya (moonless) night of the month of Margashish (November/December) with a ritual of *rohat* (log) worship, devotes the night-long drama exclusively to Danavas' do-or-die offensive to gain control of the fire. The two subsequent early morning shows revolve round the slaughter of Vritra and his mother Danu, and in this is implied a release of the water which is the abode of Vritra. The venues of these events are either within or by the side of the village temple or are in one way or another associated with it.

A huge bonfire (*bhadrana*) is lit with sanctified logs and kept ablaze throughout the night. Towards the end of the first quarter of the night, groups of Garhiyas with pine torches lighting their path swarm into the *mela* (fair ground) and busy themselves in building 'fortifications' round the *bhadrana*, with sturdy youth forming human walls. A sizeable band of warriors is kept in reserve under the personal command of Indra (represented here by the strongest and the bravest Garhiya). A selected contingent is posted at the point of entry to the fair ground. This accounts for the second quarter of the night determined with the help of stars. As the third quarter starts, Vritra in the form of a massive dragon-shaped torch made of easily inflammable pine splinters, goes round the village soliciting support from fellow Asuras, Daityas and Raksasa. The dragon — *derach* is carried on the shoulders of the Danavas. While the leader is out on his mission, the Danava warriors stealthily trickle into the ground with a view to distracting the defenders. A short while later, attackers in large numbers pour in, push the defenders back from the gate and rush to the main line of defence. The Garhiyas seem to anticipate such an offensive and stem the onslaught. Suddenly wave after wave of Danavas descend and encircle the defenders, launching attacks from all sides. It is a fierce encounter At one point, the Garhiya ranks are breached forcing Indra to join the battle. This is the moment (in the last quarter of the night) when Vritra heading a contingent of ferocious Danavas makes his entry and launches the final offensive. He pushes the Garhiya defenders helter skelter and marches straight to the bonfire. He succeeds in piercing the outer formations but is stalled by the innermost ring of the Garhiya stalwarts. Agile Indra seizes this opportunity and manages to jump on the dragon and rains blows and kicks on its head and sides, pulls out the wooden splinters one by one, as if tearing away its limbs. He lacerates its body and breaks its jaws. It is his leadership, might and valour which saves the day for the defenders. The desperate gamble of Vritra to gain the fire is decisively foiled. It is the end of the night. The battle is over and the rivals retreat from the arena.

This portrayal of the Indra-Vritra face-to-face combat mirrors the fight described in the Rigveda for the release of the water, wherein Indra breaks Vrita's jaws into pieces (RV x.152.3), maims him and scatters his limbs (RV I.33.7,8).

Vritra Tricked to Death

The struggle resulting in the annihilation of Vritra and his mother (RV I.32.9) is the theme of the early morning drama over the following two days. The interregnum between the clash over the fire and that for the water might have been turbulent with the *Ahis* apparently gaining the upper hand, for when we meet them next there is rejoicing in their camp. While in Indra's camp there is an air of silent preparation and hushed expectancy.

Immediately after the night's performance a few Danavas repair to a place traditionally believed to have been the abode of the Asuras to fetch an instantly twisted serpent-headed rope called *bandh*. People in the rival camp call it an Asura, but to fellow Danavas it is a *Naga Devata* (the *Ahi* god). On its way to the temple, the *bandh* lies for some time in a river, stream or pond evidently to signify its control over the water. Thereafter, the *Ahi* is placed in coils at the temple gate freshly washed and pasted with cowdung.. The priest worships it with rituals befitting a great deity. Ecstatic over their leader's entry into the Deva ranks, the Danavas depart for festivities and left alone, Vritra is lost in reverie. In another part of the temple, two Garhiya warriors, called *simhas*, are served a special fermented liquor made of honey (*shudung*). A *Kabiri* (bard) approaches the Asura and tricks him into joining the celebrations ostensibly arranged to mark his elevation. At some distance from the temple, he is persuaded to lead a *nati* (a popular dance form in which the dancers in chain-like formation move round in a circle). Enjoying his new status Vritra dances with gay abandon (Fig. 1). He hardly completes one round of the dance when like a flash one of the *simhas* darts forth and with a dexterous stroke of his sword cuts the *Ahi* into two and escapes post-haste from the scene. It is a traditional belief that the *Ahi* has to be

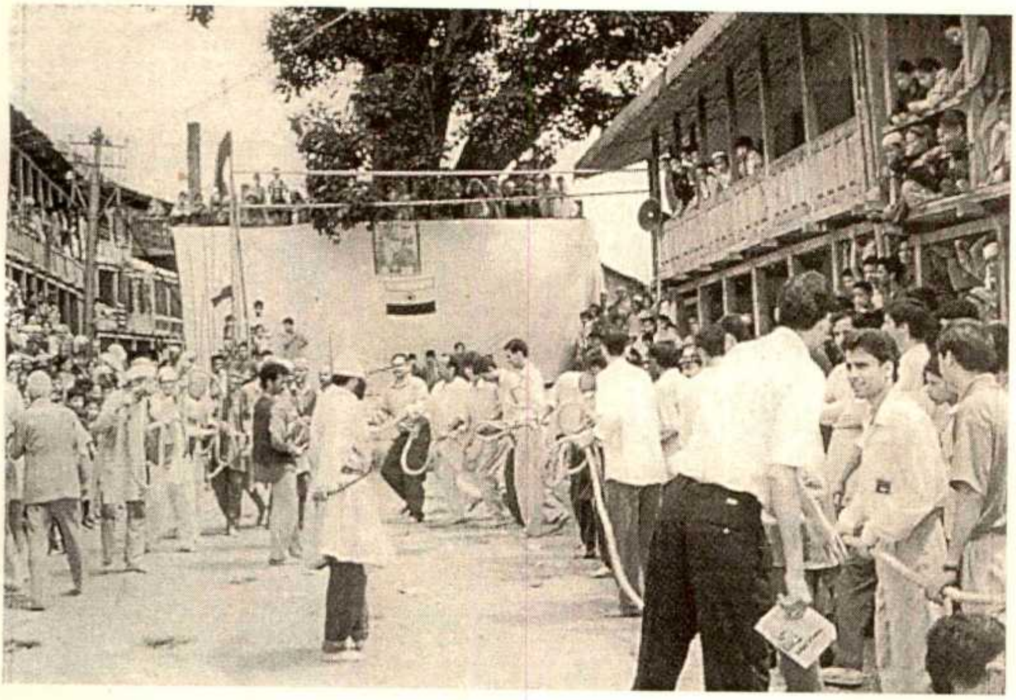

Fig. 1: A happy *bandh* dance on his entry into Deva ranks, Garhiya-Simha (in woolens) surveys the scene for opportunity to kill the *Ahi*

felled in one stroke lest he take shelter in water and become invincible. Among the waters released by Indra from Vritra's control are those of the Shutudri (Sutlej) and the Vipasa (Beas) RV iii.33.1, 2,6,7) and it is primarily in the watershed region of these two rivers that the *Diyaudi mela* is the most comprehensive with its ancient form seemingly more or less intact. The three villages of Sangla, Nirmand and Thanali in the Sutlej valley were chosen to describe this event.

The entire drama of *Vritra hanan* is generally over with the first rays of the sun. The Rigveda itself indicates that Vritra killing has to take place before sunrise to enable Indra create the dawn, sun and heaven (RV I.32.4; Sharma 1994: 101). The killer Simha and his accociates are supposed to have committed *brahmahatya* and are made to expiate this sin by arranging *saza* (feeding the community). In the Rigveda Indra too is charged with the sin of *brahmhatya* which the waters he had released have since been carrying as their foam (RV iv. 18.7). After having committed the crime, Indra flees the scene across ninety nine rivers (RV I.32.14). Before proceeding to face the mighty enemy, Indra also takes with him many pots of *Soma* and hundreds of buffaloes (RV v.29.7; ix. 113.1; x. 87.16).

In Thanali depictions, Vritra not only survives the ordeal but continues to enjoy his status as a deity and rules over dozens of villages with the help of his colleagues Argha, Shargha, Phalocha, Malocha, Snocha, Banba, Jambaa Singa and Madina (a faint echo of the Rigvedic Susna, Mani, Alk, Karanj, Numci, Dhuni, Chumri, Vachi, Jarath, Urana, etc.)

Theory of West Asian Origins

The Rigvedic account of the Indra-Vritra clash has been analysed from naturalistic, cosmogonic and ritualistic angles, yet it remains a complex topic for analysis among commentators and historians. There is no consensus even on the origin of the legend. It has been held that the myth originated in ancient Turkey, Mesopotamia, Babylonia or Iran and is evidently a by-product of the theory of Indo-European Aryan invasion and the destruction of the Sumeria-inspired Dravidian-Sisnadevah autochthonous urban Harappan civilisation. It has been held (A.L. Basham in Lahiri 1984: ixx) that "... in most of the ancient cultures of Indo-European speech... there appears a legend concerning a hero or god, who in the remote past, slew a mighty dragon or serpent. Perhaps all these stories owe something to the early diffusion of a very ancient Mesopotamian story, best known in its Babylonian form, wherein the young Marduk, the champion of the gods, slays the demoness of chaos, Tiamat and her host of monsters, and creates the Cosmos out of her dead body. Whether this legend inspired early Indo-European speakers to develop their own version of it is uncertain, but the fact remains that our oldest versions of the theme of the dragon slayer come from ancient Mesopotamia."

The *Diyaudi* depictions and the Rigvedic version, however, show that these postulates are untenable. They affirm that the myth is native to India. It originated and developed in the land of the Saptsindhus. Its prevalence in other lands has other explanations, one of them being the prolonged presence of Indians in West Asia during the second millennium B.C. and strong commercial ties even in the preceding millennium. To quote Rao (1982: 26) "... there was continuous trade contact between Mesopotamian and Indus valley sites during the third and second millennia B.C., sometimes directly and at other times indirectly. Seaborne trade was not confined to the Persian Gulf alone. It extended westwards to the Nile valley and Sinai Peninsula."

Jhiru

In marked constrast to the solemnity of *Diyaudi*, there are a number of fairs which might be branded as lewd. They are held the year round at different dates in different villages in the Himalayan watershed regions of the Chenab, Ravi, Beas, Sutlej and the Yamuna, under different names such as *Jhiru, Budha Buddhi, Lahula, Sadiyali, Ganed, Phagli, Bishu, Dakreni, Phulech, Chetrol, Sakreni, Lang, Ausar*, etc.

Jhiru and its variants uncover the Himalayan community's fixation with the sport of *sisna*, marked by uninhibited erotic exhibitionism, priapism, copulation, seductive gestures, suggestive songs and passionate dialogues. In many a village wooden phalli are stored in temples for use by players and dancers during these fairs. Where such antiques are not available, freshly felled young deodar and fir trees serve the purpose. Called *padai* or *shing* (phallusi), they are used for priapic demonstrations.

It is not humans alone who love these games. There are gods, quite a handful of them who visit their lovers in the month of Baisakh (April/May). Weeks earlier, *chetrol* is an occasion for people to give unrestrained expression to their sexual urges. A group of *khors*, masked men with *shings* dangling round their necks and tiny tinklers on their groins move leisurely to the centre of the fair venue where a large number of dancers are enjoying their *nati*. They too have *shings*. In the course of the dance, they encircle the *khors*. Face to face the two sides sing ribald songs with a view each to out-do the other. The dance movements are also seductive. Slowly, they advance towards the spectators and through words and gestures approach young women to join the fun. The invitation is rarely turned down. This seems to be the rule, rather than an exception, in almost all such fairs. Under the guise of does and buffaloes they enact scenes of copulation.

In a cluster of villages bordering Tibet, a village god publicly goes to his lover *jogini* in the neighbouring village to spend the night in carnality. He returns with the lover disguised as a forest beauty and passes the day caressing, fondling and embracing her. The lady love, her passions aroused whirls around dancing in ecstacy till she has shed, one by one, all her garments. Unmindful of her nakedness, she goes on dancing till her lover takes her in his arms once again.

Siva as Lover

Among the gods it is Mahadeo, Mesur, Siva (Mahesvar), who plays this game with rare finesse. At Sarahan, in the vicinity of the lofty Srikhand peak in Kullu District (Himachal Pradesh), Siva not only seduces *Brahm Choora*, a forest goddess, supposed to be the daughter of Brahma, but mesmerizes hundreds of other maidens during the two day *Jhiru* fair which begins on April 14 (the second day of Baisakh). As dawn breaks a group of married women of the Dumna-caste wake the deity *Sarohani deo* with their lascivious songs. He emerges from his sanctum sanctorum to don shawls of many colours and designs. The main image of the god, made of gold, is tied to the head of a chariot and dozens of other images are strung in rows below. An imposing canopy adorns the *jaman* (chariot). As he comes out, a massive almost four-storey high deodar pole (*padai*) is implanted in *urdhvam sthiti* (vertically) in the temple courtyard. He proceeds to the village square to receive homage from *suhagin ais* and *jais* (married women of kin groups). They stand in a line attired in a one-piece wollen shawl dress fastened at the left shoulder with wooden or bone pin. Each carries a tender shoot of barely and of paddy, roasted grain, flowers and incense to offer to the god who goes to each of them, leans over and receives the offerings. It is a sight to behold, the god in a state of excitement and the women standing emotionless like statues.

The *Sarohani deo* desires to visit his favourite retreat, a beautiful bowl-shaped depression lined with huge bushes of fragrant wild flowers, thick groves of pine and deodar trees and a carpet of soft green grass. Flanked on either side by groups of men and women singing songs full of sexual allusions, he rides on majestically. Nearing the deodar grove he faces a sudden shower of cowdung, pebbles and dried pine shells. Rattled, he ducks under the bushes and takes shelter behind the trees till the fusillade is over. He hurries back to the village, again to a warm reception by the *suhagins*.

The next day the reception is abandoned half way and the *deo* rushes to welcome *Brahm Choora* who has just come out of the forest. The two hug and hold each other in a tight embrace. In this moment of passionate union the finery of the goddess is crushed and her attire of leaves, tender branches, new shoots, flowers and grass reduced to tatters. They come to the square and sit side by side to watch a graceful *nati* dance in the course of which their *goors* (shaman) have a running dialogue with female dancers in language bordering on the obscene. *Brahm Choora* now has to return to her forest. She leaves reluctantly bidding a lingering farewell to her Siva. He now is reminded of another woman, his wife *Gaura* who has witnessed his dalliance. He walks up to her nonchalantly and escorts her back to the temple.

From Juansar Bawar in the Yamuna basin to Lahul and Pangi in the Ravi and Chenab valleys, the sport with *sisna*, exhibitionism, ribald songs and mock sexual indulgence have been the raison d'etre of *Jhiru* celebrations. It appears that the entire central and western Himalayan region to the extreme N-W had once been the playground of people given to carnality and promiscuity. *Jhiru*, has thus preserved the *sisna* way of life.

Rigvedic Elite's Denunciation

These ways, however, were not to the liking of a particular section of the people. During its evolution the nascent Indian society passed through many stages, faced many challenges, assimilated many influences and elements resulting in cultural contradictions. These contradictions in course of time gave birth to an elite which superficially divided the society into two classes — 'we' and 'they', i.e. the elite and the masses. The elite evolved new ethics and framed a new code of conduct. Their life and work revolved round a particular set of gods, *rik*, *yajna* and *vrata*. They were Indra worshippers who in academic circles became synonymous with the Vedic people as if the masses, the bulk of ancient society, simply did not exist. These "they", the condemned people of the Rigveda, if identified at all, were believed to have been the autochthon builders of the Harappan culture which was almost destroyed by the Aryans. "They" are said to be the Dasas, Dasyus — *akarman* (RV x.22.8), indifferent to gods — *adevayu* (RV I. 174.8), without Indra or opponents of Indra — *anindra* (RV iv. 23.7; v.2.3.; vi.25.2-3; x. 48.7), following different ordinances — *anyavrata* (RV I.33.5; I.51.8; vi.14.3; I.132.4' I.130.8; v.20.2), offering no sacrifices — *ayajnu*, *ayajvan* (RV I.33.4; I.131.4; vi.25.3), etc.

Included in the list of the denounced are the *sisna* players. The elite avoided them and sought nothing but their death. They pray to their god (Indra) not to let those whose god is *sisna* approach their sacred ceremony (RV vii.21.5). They rejoice when the *sisnadeva* cities are destroyed and their riches appropriated (RV x.99.3). But we find no aversion to the *Jhiru* followers who encompass Himalayan society as as whole, without any 'wes' and theys' either among human beings or among gods, Vedic or otherwise — none are displaced, newcomers or invaders. All are autochthons.

Khasas the Rigvedic Maruts

Among these autochthon *sisnadevah* we come across a group of people who possess all the attributes of Maruts, the celebrated sons of Rudra and Prisni (RV I.85.2; ii.33.1; I.64.12; I.114.6; ii.34.2; v.42.5; v.60.5; vi.50.4; viii.20.17), friends, companions and warriors of Indra (RV I.23.7-8; I.100.10; I.101.1; ii.41.15; iii.32.4; iii.35.9; iii.47.1; iv.54.5; vi.51.15; vii.32.10; viii.36.1; viii.52.10; x.73.1; x.99.5), his *shardhoh* (RV iii.32.4) and followers (RV v.57.1). These people are Khasa/Khasiyas spread across the Himalayas from Nepal in the east to Afghanistan in the west. They play a key role in all the ancient rituals and fairs, but their ancestry has been the subject of much speculation.

Origins: Foreign or Local?

The Khasas have been studied ethnologically, anthropologically, historically, philologically, sociologically and culturally since the 19th century. They are variously described as pre-Rigvedic, post-Rigvedic, non-Vedic, post-Harappan invaders or pre-Aryan immigrants or descendants of historical invaders, for example the Sakas, Kushans, Huns and Gurjars.

On the basis of classical Sanskrit literature and the hypotheses of orientalists, they have been called savages and barbarians (Grierson 1911: ii); outcasts (MS x. 22, 44); round-headed Alpines, long-headed straight-nosed Nordics or a mixture of Alpine and Nordic elements (Chatterji 1974: 47, 49), Caucasics (Chakladar 1962: 183), Iranians (Herzfled 1930), Greek descendants of Alexander's army or perhaps White Huns, Gurjars or Kushans (Tichy 1970: 62). They are the offspring of Prajapati Kashyap and his wife Karodhvasa (Vishnu Purana), or born of the parts of Vasistha's cow (MB Adi Parva, 176, 35-37); or are perhaps the descendants of Kusha, son of Lord Ram of the Iksvaku dynasty (local legends), or of an officer of the Kabul Emperor Kalyaman's army or may be of an ancient sage, who created the first Khasa out of 'kusha' grass (SHG: Part I, 6).

It may be possible that these Khasa/Khasiyas could well be the lineal descendants of a wave of pre-Vedic Aryan immigrants (Atkinson 1886: 379) or of those Alpine peoples who invaded the Indus valley from the Pamirs between the end of the Mohenjo-daro civilisation and the entry of the Rigvedic Aryans (CRI: 1941, I.I. 445 ff), ethnologically appearing to be Aryans (Saxena in Prarthi 1971: 197) some of whom (especially those in the Yamuna-Sutlej basin) have pure Aryan-Khasa blood (Lalit 1993: 67). Grierson (1911: xi) while specifically discussing the Aryan-speaking population of the Pahari tract (central and western Himalaya) holds that the earliest immigrants about whom we have any historical information were the Khasa, a race probably hailing from Central Asia and originally speaking an Aryan, but not necessarily an Indo-Aryan language. A firm believer in the theory of their Central Asian Saka origin, Rahul Sankrityayan (1964: 9 ff) traces the Khasa arrival in two waves: the first in 7-6th century B.C. and the second around the 2nd century A.D. Berreman (1963: 14-16) asserts that the high caste Khasiyas represent a population of Indo-Aryan speaking invaders who came into this area from the northwest either directly or through Rajasthan and that the Himalayan area may once have been the home of the ancestors of the present-day plains Hindus. Cunningham (ASR: IV, 130) however, disputes all these surmises and says that the Khasas occupied the Himalayas prior to Aryan immigration.

The theory of a Khasa invasion or immigration is however, neither supported by Sanskrit literature nor by local traditions. As Parmar says the original inhabitants of these hills were the Khasas, a people without caste or class distinctions (1975: 20). Himalayan traditions support this assertion and maintain that the Khasas were born, brought up and died here. They have peopled the southern slopes of the mighty Himalayas from Assam to the Pamirs and still further north from the pre-Rigvedic period of Indian history. This is what they themselves believe and proclaim by way of their battle cry at the start of *Thoda ka khel* (an archery contest) a main feature of the *Bishu* fair in the Yamuna-Sarasvati-Sutlej-Beas regions. This battle cry which is their introduction epitomizes certain traits which prima facie identify them with the Vedic Maruts.

Entering the arena for a bout of *Thoda*, the *thathauris* (*Thoda* players) shout in unison:

> *Chaubishao khundeo ra guru,*
> *Paurie garhao ra tikla, thode ra bhookc,*
> *Bijatao deo ra hazari*
>
> (Guru, preceptor of twentyfour *khunds*,
> and prince — *tikla*, of Paurigarh fort, I
> hunger for *thoda*. I am an attendant,
> *hazarsi*, of Bijatdeo, the god of lightning
> — Indra).

A *khund* is a cluster of Khasa villages and garh means a group of *khunds*, and those living within its boundaries are known as Garhiyas.

This announcement introduces them as the *khund* elite, lords of forts, princes of the realm, teachers of warriors, always out waging war and companions of Indra. The claim to be the preceptors and teachers of the *khund* is meant to highlight their mastery in the art of warfare. To be a prince is a mark of high birth and status. There is none high or low among them. All of them are equal, just like the Vedic Maruts who do not have any *jyestha or kanistha* (RV v.60.5). The large number of *khunds* (*chaubis* = 24) is indicative of the size of their domain, the extent of their strength and the degree of their prowess. Their most prized privilege is the companionship of Indra. They are proud of being his attendants, companions, friends and followers.

Indra has a different name in Khasa land — *Bijatdeo* in the Yamuna basin, *Goodkoodeo* in the Sutlej-Beas valleys and *Imra* in Chitral in the Indus catchment area. He retains his original Vedic name in the adjoining Afghan Kafiristan (Tichy 1970: 62-63), and his *Indra Kun* (garden) in this Vama territory is known for its stone pot, a relic of bygone ages, believed to have been the pot in which *Soma* was prepared for Indra. Just like the *Chhappasura* ceremony during the *Bishu* fair in Kinnaur (Himachal Pradesh) in the Sutlej valley, the Vamas and Anisi Kafirs still offer pots of wine and sacrifice hundreds of animals in honour of Indra and other gods (Motamedi 1957: XII 4,7).

Indra is the supreme god of the Kafirs and the Khasas. He is omnipotent, formless — yet with a form, visible as *Bijat* (lightning) and audible as a thunder — *Goodkoo*. *Bijat* has his temples and chariots; *Goodkoo* is just a log of wood, *Imra* has no form but Indra of the Hindukush has a pitcher — a *kumbh*-like image. Rumbur, Brumburet and Birir in the Chitral valley and the Vama and Anisi areas in the Afghan Hindukush are akin to the *khunds* in the western Himalayas. The Khasa and their *khunds* are synonymous as are the Maruts and their *ganas*. The Vedas frequently mention *Marutam ganam* (RV I.13.4; YV xxxiii.35), *Marutenah ganam* (RV v.32.2) and *Marutam ganah* (YV xviii.45; AV iv.13.4). Khasas are expert archers and their favourite traditional weapons have been the *dhanu, shari, dangara and dinga* (the bow, arrow, battle-axe and stick). Maruts too had the arrow, battle-axe and spear as their main weapons (RV I.39.2; I.64.10; v.53.4; v.57.2; vi.75.9,11,15,17; vii.46.1; viii.20.4 and x.103.2-3) (Fig. 2).

The Vedas have verses where the Maruts are said to be human beings who attained godhood by virtue of their good deeds (RV x. 77.2). They are *maryanso divasputras*, *maryo* (RV ii.31.7; iv. 20.5; ix.96.20), *marya* (RV I.64.2), *marya* (RV iii.33.10; v.53.3; vii.56.16; vii.56.1) and *martya* (RV I.38.4). They have been called *nara* at least 34 times in the Rigveda and *Manusa* as well (RV v.52.4; AV vii.73.3). The Khasa, the *martyas* are thus in all likelihood the Rigvedic Maruts and the Himalayan autochthons.

Bhunda-Purusmedh

The western Himalayas also preserve a ritual which has survived from a time when Rigvedic society was in intellectual ferment. Existing beliefs and practices were then being questioned and critically examined. The *Bhunda* ritual was introduced in the Himalayas probably to ensure its continuance when the cultural environment in the Indus-Sarasvati basin had become uncongenial. The traditions in the region west of the Yamuna give credit for this to the

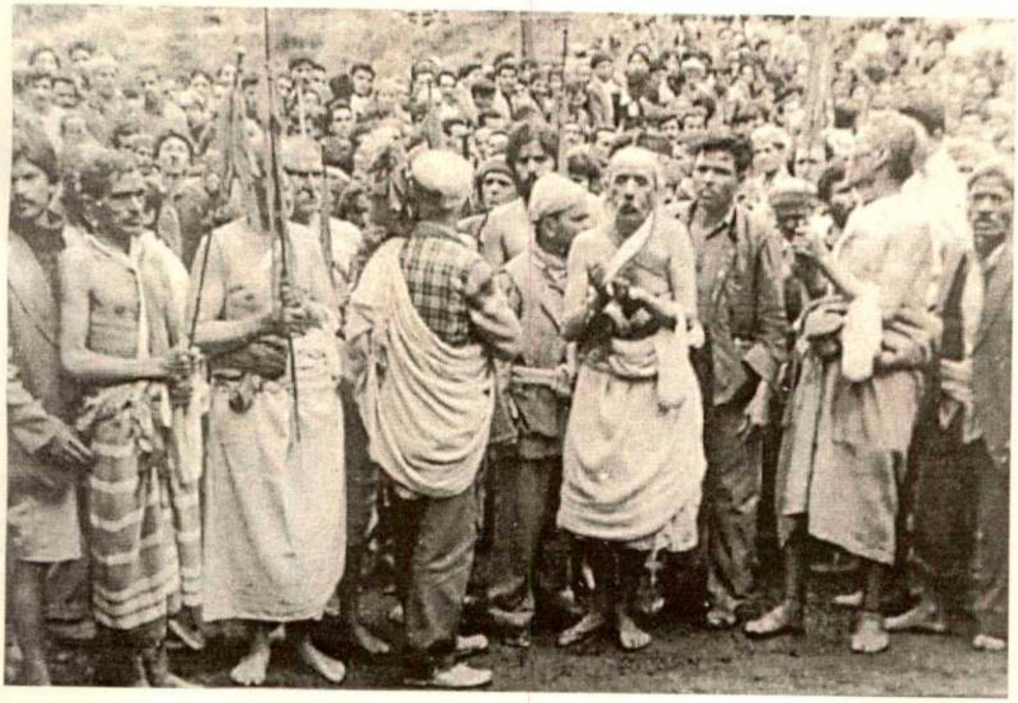

Fig. 2: *Goors* (shamans with bare torsos) go round the village to drive away evil spirits who might disrupt the *Bhunda* ritual

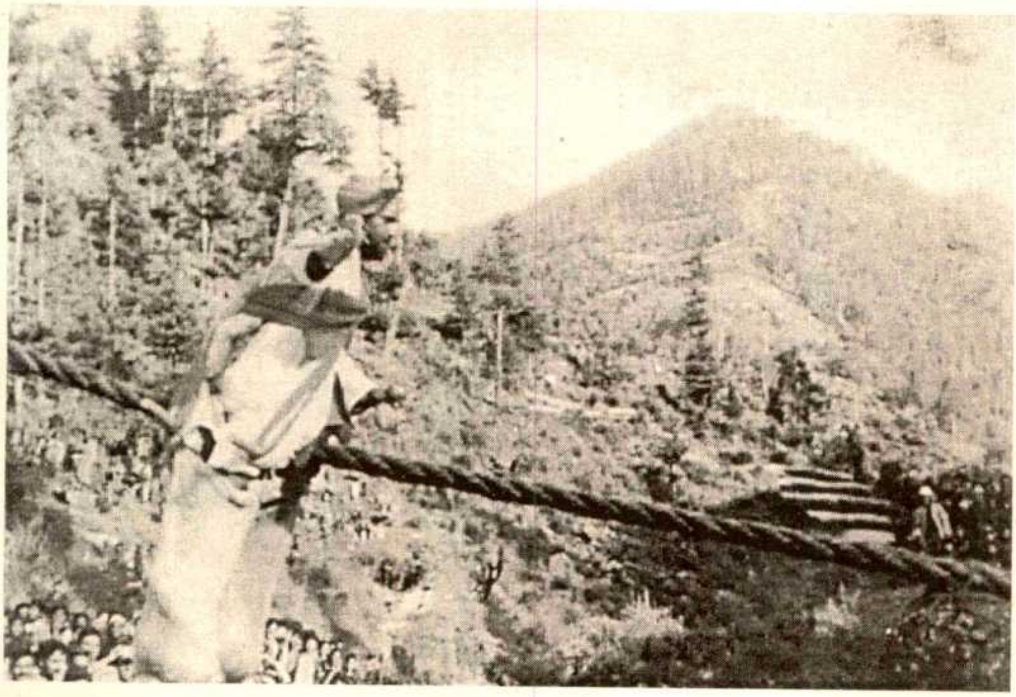

Fig. 3: *Beda* Surat Ram after dedication to gods slides down an inclined rope to life and riches (this was his seventh rope slide)

legendary Parasurama, who brought the Harappans to settle here. Five such settlements, locally known as *sthans*, are situated along the banks of the Sutlej, upstream of Ropar. Enjoying an almost Vatican-like status, these *sthans* are proud of their ancestry and the émigré status. It is they who are the nodal group for the performance of this "*jag*" *yajna* (Kashyap 1984: 42-66).

Bhunda is one in a series of *yajnas* which correspond to the Vedic *ajmedh* (goat sacrifice), *gomedh* (kine sacrifice), *asvamedh* (horse sacrifice) and *purusmedh* (human sacrifice). The local names for these being respectively *Bhadoji, Bhadpur, Shant and Bhunda*. These sacrifices used to be held every 12 years, with a three year interval among them, and all of them were performed strictly according to Vedic rituals minus the actual slaying of kine, horse and man. The focus of late, has been exclusively on *Bhunda* with its spectacular rope sliding by the man who has formally and ritually been offered to the gods. This five day ceremony is similar to the Rigvedic story of a composer of hymns called *Sunahsepa*, who was offered to Varuna and other gods. Moved by the mercy pleas of the sage, the gods spared his life (RV I.24; I.25). In *Bhunda* too, on the last day of the month-long oblations, a man belonging to the *Beda* (Vedic *Vratya*) caste, is formally dedicated to the gods, but his life is not taken. Instead, he slides down a steep incline on a self-plaited rope to life, public acclaim, riches and deity-like status (Fig. 3).

This rope sliding innovation in *Bhunda* evidently marks an important point in the evolution of Indian culture when Vedic society consciously adopted a middle path between *ahimsa* (non-violence) and *himsa* (violence) and abolished the killing of the *yajna pasu*, a synonym for the man chosen to be sacrificed. Objections to animal sacrifice had begun to be raised in the Rigvedic period itself. We find a Rigvedic decree that *Yatudhanas*, who eat human, horse or cow flesh be beheaded (RV x.87.16), and further that their families also be exterminated (RV x. 87.10). The cow had probably by then become *aghnya* (non-slayable) (RV I.164.40; YV I.1).

Another feature of the *Bhunda* performance is Varuna worship by *suhagins*. It is an occasion for community affirmation of their fidelity, character and status. This approbation has, however, to be earned after a nerve-shattering ritual and a rigorous test. It seems that by the time of the Harappan decline social focus had shifted from fertility to fidelity. Animal sacrifices were prevalent during the Harappan period as evidenced by sacrificial pits in which kine and horse bones have been found at Mohenjodaro, Lothal and Kalibangan (Rao 1973: 138-141).

Conclusion

One might say that these living traditions in the Himalayan region overturn the postulate that "the Indus civilisation has replaced the Vedic Aryan culture as foundational to Indian history" and that "the cities of the Indus pre-date the Vedic culture by at least a millennium" (Thapar 1992: 9-10). We find that the Rigvedic Indra-Vritra legend and the Himalayan *Diyaudi* predate the Babylonian and Mesopotamian civilizations; that the so-called Harappan *sisnadevah* continue to play their *sisna* game even today and are an integral part of the Himalayan community which considers the Khasa *Khasiya* to be the Rigvedic Maruts as its predominant constituents; and that the Harappans performed Vedic animal sacrifices which were still performed according to Vedic ritual in the late Harappan settlements comprising a cluster of villages at least in the valley of the Sutlej, once a major tributary of the Sarasvati.

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Abbreviations

AV	—	Atharvaveda
RV	—	Rigveda
YV	—	Yajurveda
MB	—	Mahabharata
ASR	—	Archaeological Survey Report
CRI	—	Census Returns of India
LSP	—	Linguistic Survey of Punjab
MS	—	Manusmriti
SHG	—	Simla Hills Gazetteers
OST	—	Original Sanskrit Texts

Isampur: an Acheulian Workshop Site in the Hunsgi Valley, Gulbarga District, Karnataka

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Introduction

This note provides a preliminary account of the results of field-work conducted by the authors in March 1997 at an Acheulian site near the village of Isampur (30° 17' N; 76° 29' E) in the the northwestern part of the Hungsi valley (Gulbarga District, Karnataka). This site, discovered by the first author in March 1983, forms part of a group of over 120 Acheulian sites brought to light by him in the Hunsgi and Baichbal valleys over the last two decades (Paddayya 1982, 1987, 1991). Isampur lies in a gorge-like sub-valley drained by a seasonal stream locally known as the Kamta Halla, which forms one of the main feeders of the Hunsgi Nullah (Fig. 1). The Acheulian site is located 2 km northwest of the village and about 150 m from the left bank of the Kamta Halla. It is situated about 1 km east of the major irrigation canal in the area called the Narayanpur Left Bank Canal (NLBC) which originates from the huge reservoir at Narayanpur on the river Krishna.

The Site

The site forms part of the pediment surface and lies about a kilometre from the base of the shale-limestone plateau skirting it on the northern and eastern sides. It consists of two localities (II and III) separated from each other by a small distance of 50 m. These were found in a large, oval-shaped area (measuring about 300 m across) covered with 3 to 4 m thick brown/black silts which had earlier been quarried by the Irrigation Department of Karnataka State to prepare the embankment of the major canal mentioned above. Each locality was a cluster of 10 to 20 artefacts spread over small patches (15 m across) of brown silt deposit. Limestone was the principal raw material and the artefacts included handaxes, cleavers, chopping tools and flakes. From the unabraded condition of the artefacts it was clear that the two localities were of the primary type.

In November 1994 the authors revisited the site at Isampur as part of their joint work to investigate the Stone Age sites of the Hungsi and Baichbal basins from the point of view of site formation processes (Paddayya and Petraglia 1993, 1995). Two important observations were made during this visit. First, examination of sections in the dug-out area revealed a 25 cm thick conglomerate of angular blocks of limestone overlying bedrock (limestone). The surfaces of the limestone blocks were encrusted with a distinct layer of the kankar or calcareous material. This conglomorate was in turn overlain by brown and black silts, each deposit measuring 1 to 1.5 m in thickness.

Secondly, one of the two Acheulian localities (Locality II) discovered earlier by the first author turned out to be much more than a surface cluster of 20 artefacts. These artefacts were found to form part of a larger locality extending over the grass-covered bed of a shallow, first-order stream, which descends from the shale-limestone plateau to the north and joins the Kamta Halla after a distance of 150 m. On account of stream erosion bedrock was exposed in patches; other patches were covered with a silt deposit measuring up to 0.5 m in thickness. More than 60 artefacts were noted in an oval-shaped stretch (30 to 40 m across) of the stream course. These included cores, large flakes, small debitage pieces, a few handaxes and cleavers (all of limestone) and a few hammerstones of chert and quartzite. There were indications that in certain cases limestone blocks of suitable sizes were dislodged from the bedrock. Based upon these data it was felt that the locality was an Acheulian workshop located at the raw material source itself. Moreover, close inspection of the surface features made it clear that the site still preserves a regular cultural horizon beneath silt deposits of varying thickness.

The authors therefore undertook further fieldwork at the site in March 1997. This work involved: a) intensive explorations in the surrounding area to understand the

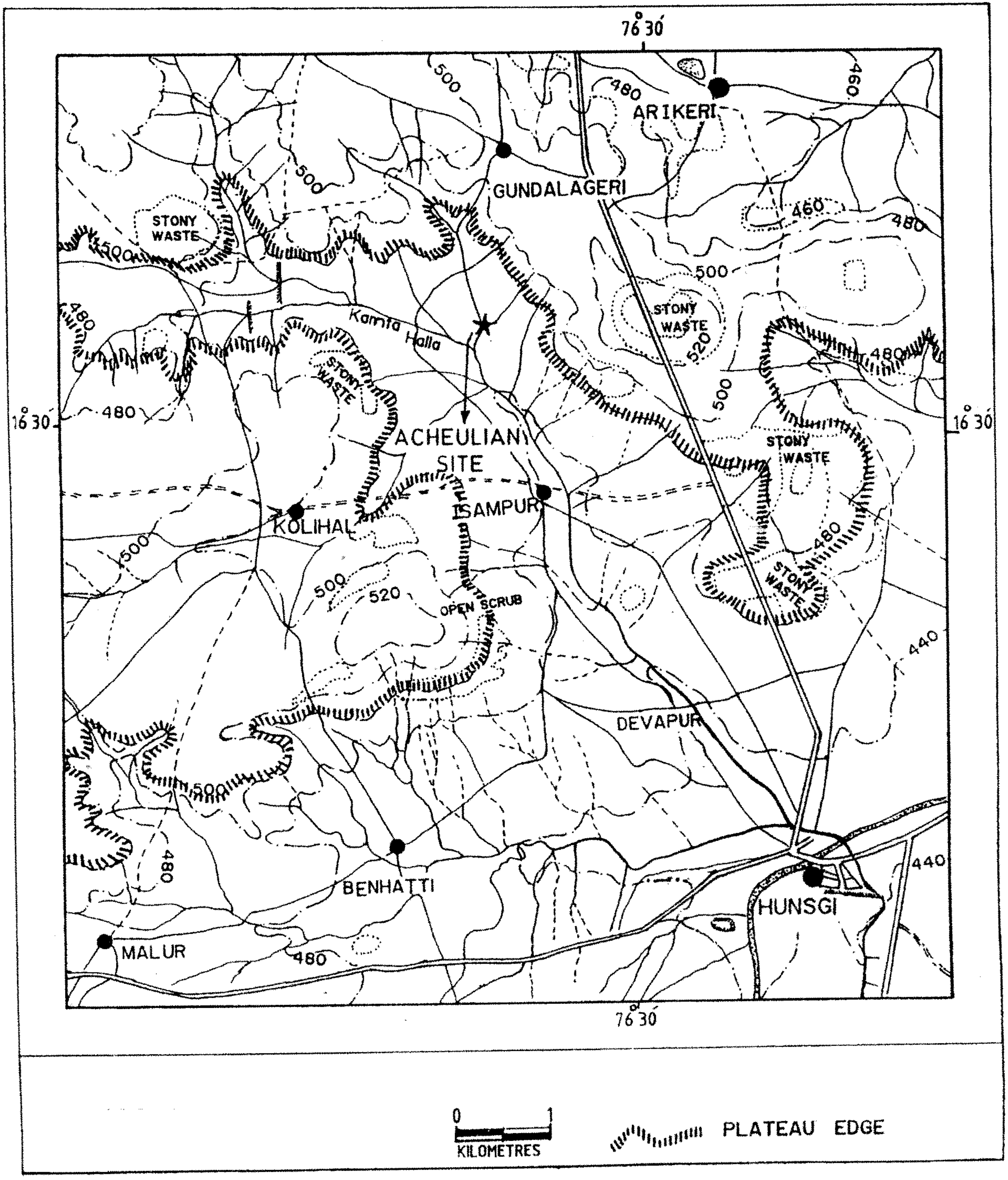

Fig. 1: Map of the northwestern part of the Hunsgi valley showing the location of the Isampur Acheulian site

geomorphological setting and sedimentary context of the site, and b) trial digging in order to ascertain the extent of the Acheulian level and its stratigraphical context and cultural features.

The Results

The site forms part of the limestone pediment surface and lies on the 470 m contour level. Our examination of sections preserved in rain-cut gullies, field bunds and cuttings in the area from where the Irrigation Department had quarried soil for the canal embankment revealed that the dug-out area is part of a large, shallow basin-like depression now filled up with 3 to 4 m thick brown/black silts. It measures 500 m north-south (possibly even longer) and 400 m east-west and probably resulted from the removal of rock debris from the limestone pediment surface on account of sub-surface drainage which is common in limestone terrain. Another possibility is that the depression represents an ancient drainage feature of the valley floor. It has sloping sides made up of limestone and was subsequently filled up with brown/black silt deposits measuring 3 to 4 m in thickness. The pediment surface around the topographic depression is covered with a 1 to 2 m thick silt deposit. On account of erosion the silt deposits have been partly removed.

The Stone Age locality lies on the western edge of the depression. It is mostly occupied by the bed of the shallow and south-flowing field stream descending from the plateau. The watercourse has some scour pools and is covered with scrub vegetation consisting of grasses, *Acacia* and *Cassia* trees (Fig. 2). The Stone Age site partly also covers agricultural land on both the western and eastern sides of the watercourse. Twelve test pits (1x1 m) were dug in order to ascertain the spatial extent of the cultural horizon. These revealed that the locality measures about 80 m north-south and 70 m east-west. Over 120 artefacts of limestone were noticed on surface and their positions were plotted. Barring 12 specimens of handaxes and cleavers, the assemblage basically consists of flakes of large dimensions (measuring up to 25 cm long and 20 cm broad) and cores made up of limestone blocks (measuring up to 35 cm long and 30 cm broad). Four hammerstones of chert, quartz and quartzite, and a large number of debitage flakes and chips were also noted. From all these features it was clear that one was dealing with a primary site where a considerable amount of chipping took place.

The test pits mentioned above exposed black silt,varying from 15 cm to 60 cm in thickness, above the bedrock. In the area occupied by the watercourse the sediment cover was considerably less, as most of it had already been eroded away. One of the test pits dug in the agricultural field on the western side of the watercourse revealed a 1.2 m thick sediment cover (the bottom consisting of brownish silt and the upper portion made up of black silt).

It is important to note that most of the pits exposed a regular Acheulian cultural horizon lying directly on the limestone surface. With a view to obtaining a better picture of the stratigraphical and cultural aspects of the horizon, one of these pits was extended (Trench 1) to cover a total area of 3 m^2 which showed the following stratigraphy:

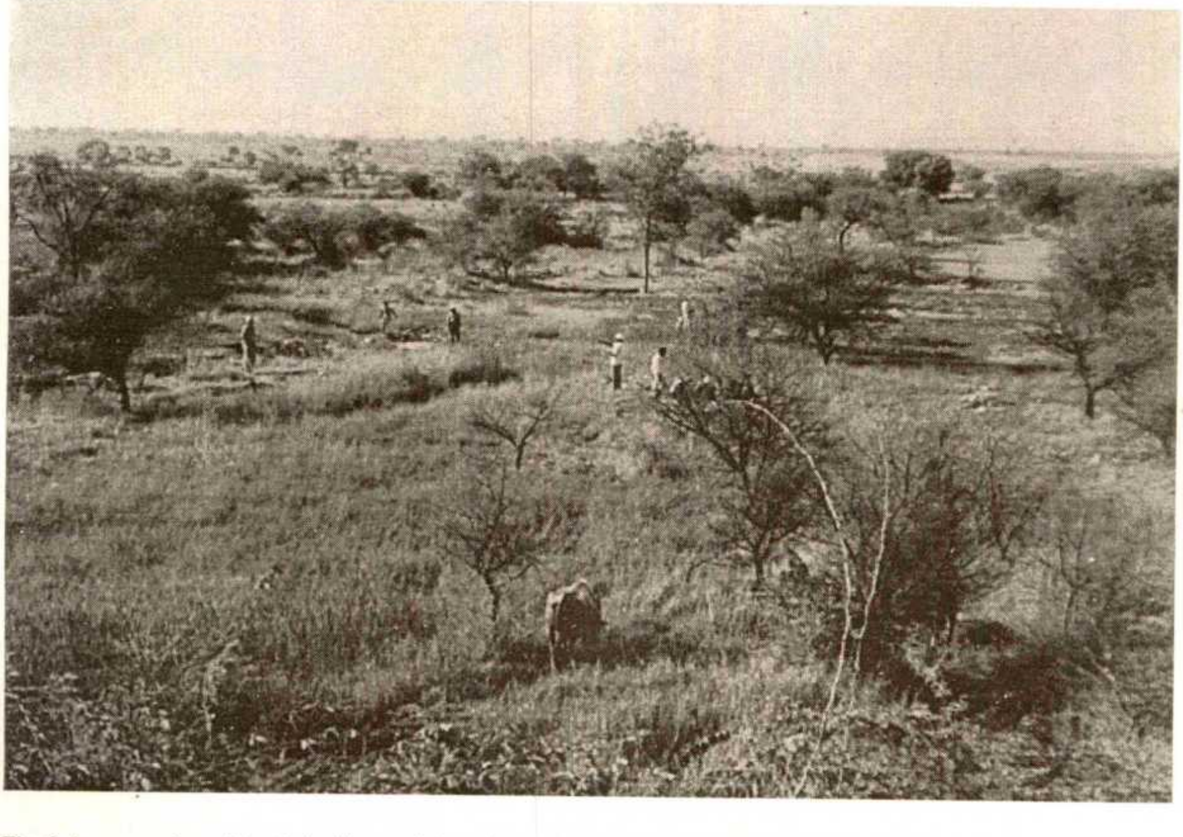

Fig. 2: Isampur: view of the Acheulian workshop site, with the shale-limestone plateau in the background

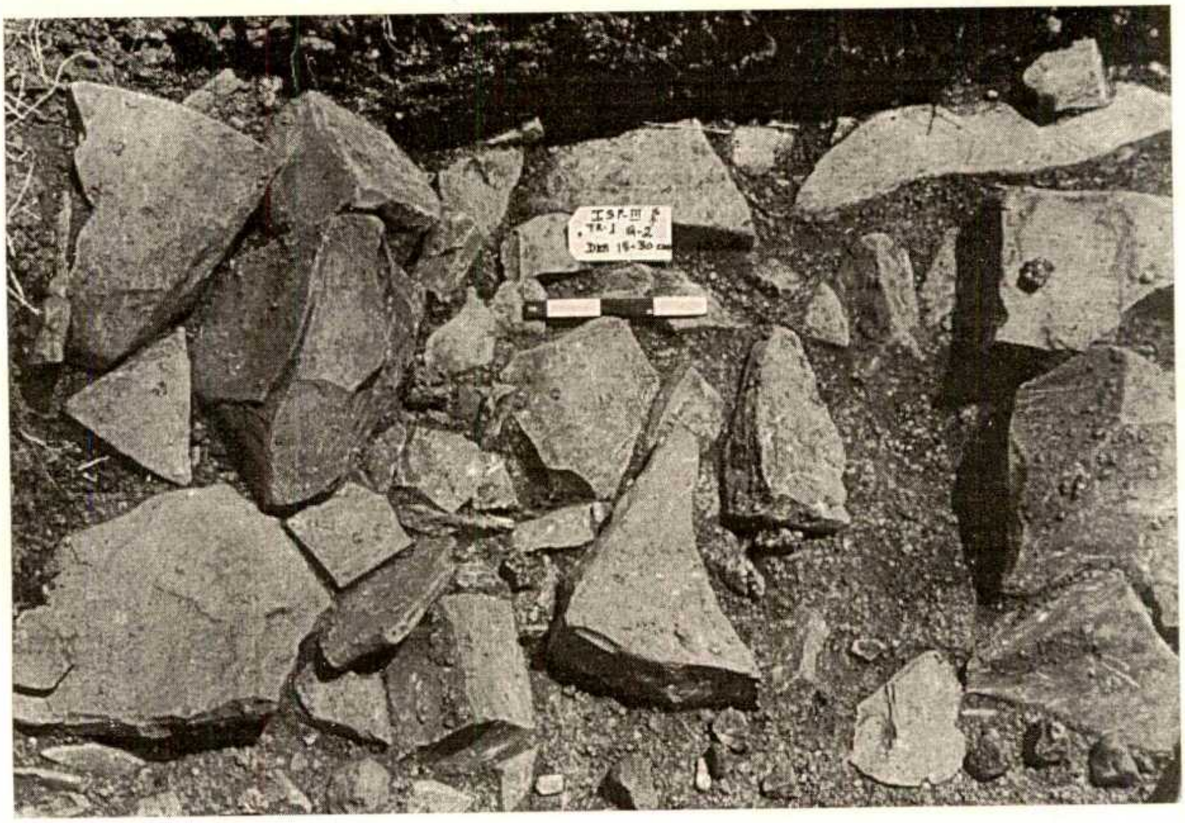

Fig. 3: Isampur: Acheulian cultural level (15-30 cm below surface) with limestone cores, flakes and debitage exposed in Trench 1

Layer 1: Black, sticky clay (10 to 15 cm thick)

Layer 2: Colluvial gravel (5 to 8 cm thick) made up of angular to subangular pieces of chert and other rocks. This is a post-Acheulian gravel deposit laid down by surface runoff.

Layer 3: This was the Acheulian horizon proper and measured about 20 cm in thickness. It consisted of limestone blocks and artefacts, all set in a matrix of hard kankary brown silt. This whole layer was quite hard to dig and rested on limestone surface (Fig. 3)

The Acheulian horizon (layer 3) was excavated as two levels (20 to 30 cm below surface and 30 to 40/45 cm below surface). These two levels together produced over 200 artefacts comprising 10 cores made of limestone blocks with evidence of flaking, about 50 large flakes, 2 hammerstones (one of chert and the other of basalt), 1 biface and the rest consisting of debitage (Figs. 4-6). The level also yielded 6 limestone blocks measuring up to 35 cm across and up to 12 cm in thickness. Obviously these blocks were meant to be used as cores for flaking. On the negative side a striking feature of the site concerns the extremely low proportion of finished tools.

Observations

The site forms part of the limestone pediment surface and lies on the edge of a shallow topographical depression formed on the valley floor due to erosional activities. Availability of cherty and cream-coloured limestone blocks

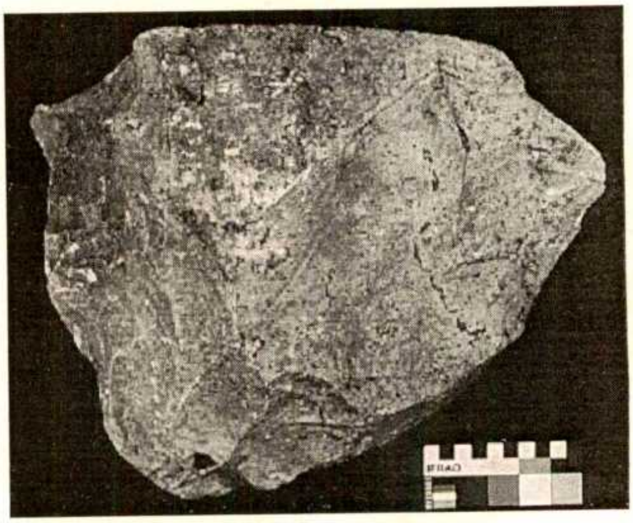

Fig. 4: Isampur: limestone core from the Acheulian horizon in Trench 1

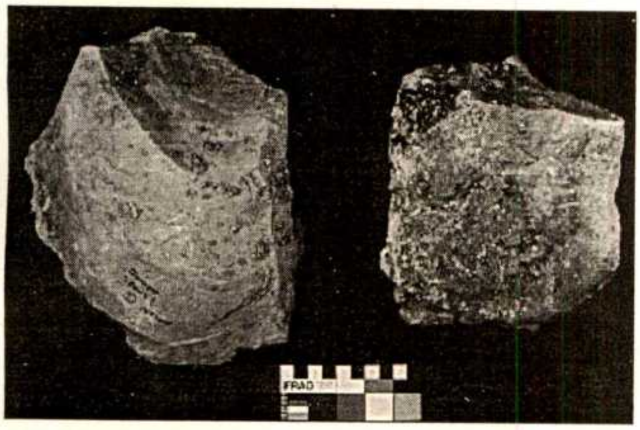

Fig. 5: Isampur: limestone flakes from the Acheulian horizon in Trench 1

of suitable sizes and shapes, all forming part of the pediment surface, and a secure water supply in the adjoining shallow depression seem to be the main factors which favoured the selection of the site by the Acheulian group.

The site is undoubtedly of the primary type and was subsequently covered by brown and black silt deposits measuring over a metre in thickness. It has been exposed to the surface in modern times due to the erosion of overlying silt deposits by field streams with definite channels which owe their origin to the activities of farmers to raise bunds around their farms to arrest soil erosion.

The Isampur site has a special place among the Acheulian sites of the Hunsgi and Baichbal valleys in particular and the Lower Palaeolithic sites in India in general, because the tool-making activity here was geared not to the production of finished types but rather to the creation of blanks in the form of large flakes which could be transported to occupation sites in the vicinity for further shaping into knives and bifacial types. It is therefore a true workshop site located right at the geological source of raw material and even preserves clues that in some cases the limestone blocks were being dislodged or quarried from the bedrock for the purpose of flaking.

In view of the special nature of the site the authors have plans to carry out further work to understand its geoarchaeological aspects and the hominid behaviour encoded in raw material exploitation and reduction sequences.

Acknowledgements

The authors are grateful to S.K. Aruni, S.K. Bilal, Philip Laporta, D.D. Phule and Sunil Jadhav for their valuable assistance during fieldwork at the site in March 1997. They

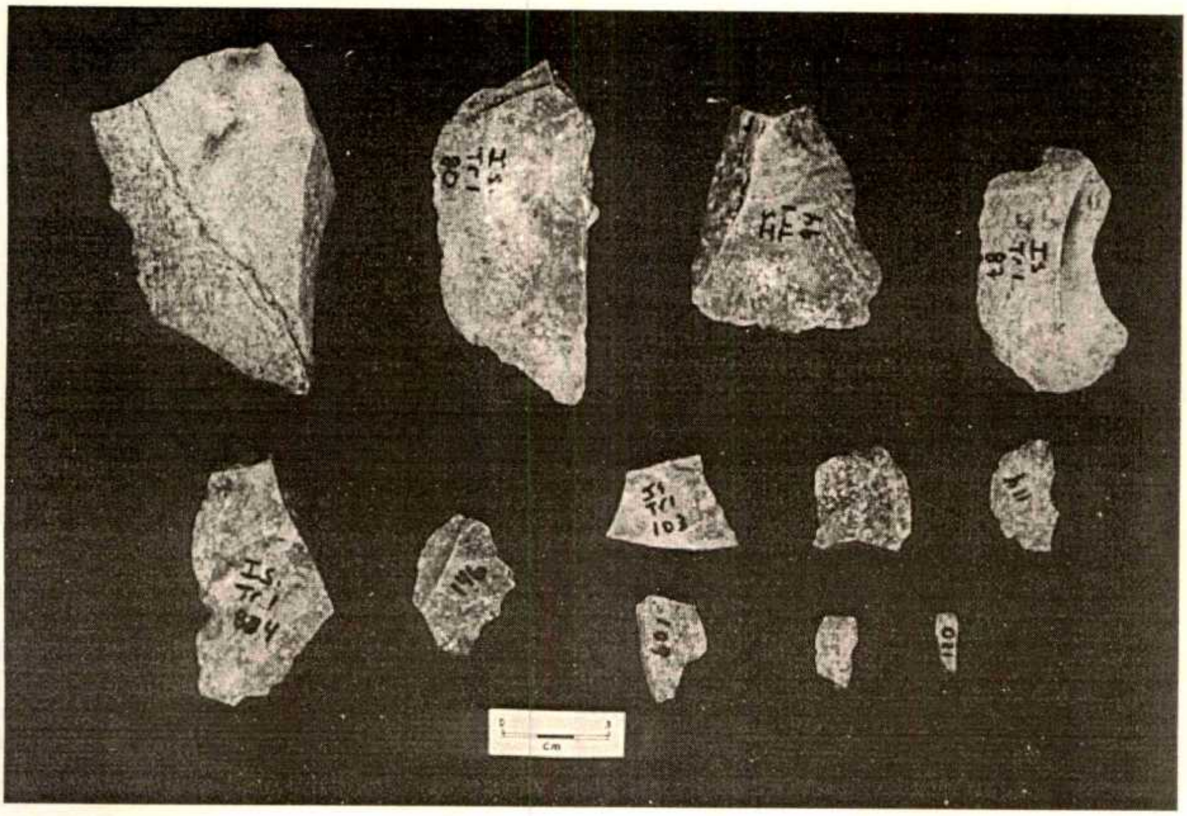

Fig. 6: Isampur: limestone debitage (flakes and chips) from the Acheulian horizon in Trench 1

also deeply appreciate the cooperation extended to them by Aminappa Harnal and Basareddy Navadgi who own the farmland around the Acheulian site at Isampur.

Philip Laporta is making a detailed study of the structural and petrological aspects of the limestone beds near Isampur. Joseph Schuldenrein is collaborating with the authors in the study of the geoarchaeological features of the Hunsgi and Baichbal valleys.

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Trauma and Deccan Chalcolithic Decline: Fallacies and Facts

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Introduction

Issues related to the decline and end of the Deccan Chalcolithic phase have generated much scholarly discussion. Several hypotheses have been offered to explain the enigmatic termination of this cultural phase. The drastic change in the climate around c.1000 B.C. leading to increasing aridity, thereby making people modify their subsistence strategies, has been stated as the prime factor responsible for this (Dhavalikar *et al.* 1988).

Review articles published in the recent past (Shinde 1994; Naik and Mishra 1997) quote traumatic injuries reported on human bones and/or the burial pattern of the Inamgaon skeletal series to interpret the tragic and abrupt end of this culture. Such inferences, however, seem unjustifiable. Usage of anthropological data to conclude about the decline appears to be far fetched and unconvincing.

I would like to elucidate here the correct meaning of the pathological diagnosis offered. Comments have also been offered for the 'aberrant' burials found at the site of Inamgaon.

Proposed Hypothesis

Shinde (1994: 176) states that, "There is a strong possibility that the Megalithic people, equipped with effective iron implements and fast moving horses, began to arrive in the Deccan around 800 B.C. and were responsible for the end of the Chalcolithic culture in this region. The evidence from Inamgaon suggests that the most of the exposed permanent rectangular structures of the last phase were burnt down and possibly a large section of the population was massacred, which is clear from their burials. In the earlier phase the adults were ceremoniously buried within the house floor with utmost care and usually only one person was buried in a single pit. But in the last phase the presence of more than one skeleton in one pit, an absence of burial goods in many cases, and missing limbs such as a hand or a leg or even the head of a skeleton lead one to infer that perhaps because of large scale killing, it was difficult for the survivors to perform the last rites properly and give a ceremonial burial. Possibly the surviving people were taken away by the invaders as slaves or were absorbed by them into their society."

Naik and Mishra (1997: 54) while quoting Shinde (1994) state that, "... there is evidence of conflicts from the Late Jorwe levels at Inamgaon based on the human skeletal remains from which Lukacs and Walimbe (1976) identify evidence of death due to trauma."

Comments

The aforesaid propositions about the decline of the Chalcolithic phase, especially at Inamgaon, cannot, however, be supported by the anthropological evidence.

I. Trauma

Neither in the source (Lukacs and Walimbe 1986) quoted by Naik and Mishra (1997), nor in other publications dealing with pathological lesions on the Inamgaon skeletal series (Lukacs *et al.* 1986: 301-303; Walimbe and Tavares 1995: 525-527), have traumatic lesions been interpreted as the direct cause of death. These studies report five cases of traumatic injury, of which four can be attributed to some kind of dynamic stress, the explanation for which is as follows:

Skeleton 116 (Early Jorwe Phase, sealing layer 7, female, 30 to 40 years): The diaphyseal shaft of the right humerus exhibits a well-healed mid-shaft fracture. There is secondary osteogenesis and callus formation at the site, a typical response to a bone injury which signifies the status of the healing process. Alignment of the bone is slightly affected. The Callus is almost completely resorbed, indicating that the trauma occurred and began healing well before the death of the individual.

Skeleton 122 (Early Jorwe Phase, sealing layer 9, infant, 4.5 to 5 months): The proximal half of the right humerus shows a marked medial inclination. Bones of infants and children have a great potential for corrective modelling, and because of their elasticity they often show a tendency to bend (like a green bamboo stick) rather than break. Such "bending" fractures in immature individuals are termed as "greenstick fractures".

Skeleton 197 (Late Jorwe Phase, sealing layer 4, female, 14 to 15 years): This specimen exhibits both fracture and possible dislocation of the left shoulder girdle. A fracture of this type occurs when the victim falls on a flexed elbow. The force of the fall is seen travelling along the humerus and is expended on the glenoid, shearing off a portion of the bone. Slight healing is evident in the form of the beginning of the formation of secondary fossa at the glenoid, and thus the incidence cannot directly be taken as a cause of death.

Skeleton 196 (Late Jorwe Phase, sealing layer 4, child, 7 to 8 years): On the upper left quadrant of the occipital is an ovoid depression. The area immediately surrounding it exhibits mild osteoporosis. The lesion can be diagnosed as a healed depression fracture due to a blow with a small blunt object or a lesion due to yaws. Though a fracture is perhaps a more plausible etiology, since only the outer table of the bone is affected with no involvement of the internal table, the second possibility cannot be altogether ruled out.

In view of the aforesaid descriptions, while putting forward any statement on traumatic evidence as a factor for Chalcolithic decline several points should be taken into account, including age-sex prevalence of the lesion, status of the healing process, occupation, and the temporal context of the individual.

First, it needs to be borne in mind that of the four cases listed above, where the traumatic lesion could be the result of a sudden blow, two individuals are identified as females and two are children. It is very likely that if at all there was any tragic event, the victims would primarily comprise adult males and not females, and certainly not young children, even less so an infant of 4 or 5 months.

It may also be noted that a relatively higher percentage of traumatic injuries for females have been reported for the early farming societies than for hunter-gatherers and are related to increasing mechanical stress (Cohen and Armelagos 1984).

Secondly, the fact that the fracture in Specimen 116 is well-healed is indicative of the survival and recovery of the individual. It also indicates some treatment and after care offered after the trauma event. In other words, such a pathological lesion should be quoted to infer a knowledge of health care, and also of high social values of the population and not to speculate on interpersonal conflicts.

Thirdly, of these four cases, two belong to the Early Jorwe period. The two incidences reported for the Late Jorwe phase are assigned to sealing layer 4. The site of Inamgaon was under habitation for at least 300 years thereafter.

II. Mode of Burial

Shinde (1994) also quotes the evidence of multiple burials (where two or more individuals were interned) or fractional burials (where certain body parts were missing) while putting forward his hypothesis of 'massacre'. In my opinion the following explanation is more tenable for these types of burials.

a. 'Partial' burials

In the anthropological report dealing with the Inamgaon series (Lukacs and Walimbe 1976) a detailed inventory of the skeletal elements available for study is given. Cases where certain body parts are 'missing' does not necessarily mean a secondary mode of burial. In most of these cases the skeletal parts were found anatomically correctly oriented. The reasons for the non-preservation of certain body parts could be many, e.g., post-mortem decomposition of skeletal tissue by water logging, root/rodent activity, chemical composition of the soil, pressure of the superincumbent deposit, excavation damage and loss.

b. 'Fractional' burials

One of the burials (Burial 145, Late Jorwe Phase, sealing layer 4) which yielded remains of a child of about 3 years is enigmatic. Not all parts of the body were present. The skull and many of the post-cranial bones are missing. Besides, the tibia and fibula of both sides, the left side ribs and shoulder girdle, as well as, the right pelvis were missing, more surprisingly counterparts of these bones were present. It appears that the dead body was carefully wrapped in grass traces of which were found at the bottom of the pit and on the bones. Dhavalikar (1986: 11) interprets it as "a peculiar custom in vogue at least for a few people during the Early and Late Jorwe periods". Also to be noted is its 'extended' type. Normally children of this age-group were buried in twin-urn mode. This child also evidence pathology of periostitis, a non-specific infection. Moreover, the fact that this burial was sealed by layer 4 would dissociate it with the 'invading activity', if any.

Dhavalikar (1986) mentions an isolated skull which was carefully buried in a small pit (Burial 91, Early Jorwe Period, sealing layer 7). The female of 40-50 years buried in this pit was represented only by an excellently preserved left side of the skull. Dhavalikar comments "it is impossible to hazard any opinion about it but the only possibility seems to be that the person probably died of unnatural death; may be he (she) was killed by a wild animal while hunting or in a battle with a neighbouring tribe. But the person occupied an important position in the society and desolated a ceremonious burial. Hence only the skull, which could only be recovered, was given a ceremonious burial" (Dhavalikar 1986: 11). While commenting on the same burial in subsequent publications, he opines that, "... it is also likely to be an instance of head-hunting which is prevalent among the Nagas of Eastern India" (Dhavalikar *et al.* 1988: 296). Whatsoever be the reasons, the burial is associated with the Early Jorwe levels, and not the late phases, when disturbances from Megalithic invaders has been postulated (Shinde 1994).

Mention must also be made of a child burial (H-105, belonging to House 105, sealing layer 4). The pit for this burial could not be traced for this burial since the house had apparently caught fire and the location of the burial was below a burnt post of this house. The left side of the skeleton of this individual, aged 5 to 6 years, was exposed to fire and many bones are charred. The specimen has been studied pathologically. The absence of both transverse and longitudinal cracks or warping (which should characteristically appear if the body was exposed to fire in 'flesh-on' condition) indicate that the exposure to fire occurred only after the specimen was skeletonized and the bones dry (Lukacs and Walimbe 1986: 200) the death of this individual most certainly cannot be attributed to the fire.

c. 'Symbolic' burials

At the site of Inamgaon there are several instances where the burial pit did not contain any human bones or where the individual is represented by only a few bone fragments. These symbolic burials probably denote a different type of death ritual prevalent at the time where the body was probably exposed or cremated first and only a few bones were ceremonially buried at a later date. Skeletal remains, wherever present (in small quantity) are however not available for scrutiny of fire exposure marks. Nevertheless, the very fact that the death rites were offered by burying the dead 'symbolically' itself indicates the concern of the survivors. It may be mentioned that some of these symbolic burials even contained funerary vessels of graceful shapes (for example, Burial 28, Late Jorwe Phase, sealing layer 1) (Dhavalikar *et al.* 1988: 338)

d. 'Multiple' burials

There are several instances of multiple burials where more than one individual is interned in a single burial pit. It needs to be emphasized that such burials, which have been used to hypothesize invasion of more powerful and better equipped Megalithic people, are not only confined to the later levels but occur in all phases, the Malwa Phase (Burial No. 129, 130), the Early Jorwe Phase (Burial No. 103, 124) and the Late Jorwe Phase (Burial No. 63, 146 168, 175, 179, 194, 199, 205, 206, 208) (Lukacs and Walimbe 1986). More evidence of multiple burials in the Late Jorwe Phase can more likely be attributable to proportionately more extensive excavations at these levels.

Table 1: Details of multiple burials belonging to the Late Jorwe cultural phase at Inamgaon

Burial No.	**Sealing Layer**	**No. of Skeletons**	**Age and Sex of the Individuals Interned***
63	5	2	foetus to 2 months; foetus to 2 months
146	3	2	female, 30-40 years; male, 40-45 years
168	2	2	female, 16-17 years; male, adult
175	5	2	5-7 years, 7-8 years
179	1	2	6-7 months; 1.5-2 months
194	5	2	4.5-5 years; 2-3 months
199	5	2	male, 17-19 years; female, 30-40 years+
205	4	2	perinatal; 6-12 months
206	1	5	3 years; young adult; three middle-aged#
208	1	2	7-8 years; male, 25-35 years@

Notations used:
* sex determination not possible for sub-adults
+ most probably with close biological relationship.(mother and son?), as based on the occurrence of a rare morphological trait
# sex-determination not possible for these adults
@ pathology of spina bifida is recorded for this adult

Details of the ten burials belonging to this phase are given in Table 1.

It is evident that of the ten multiple burials, belonging to the Late Jorwe Phase and yielding skeletal evidence of more than one individual, six burials belong to the early or middle levels of the Late Jorwe Phase. Only four burials can be ascribed to the late levels of the Late Jorwe phase, where disturbance from iron-using invaders was expected. Of these a single burial (No. 168) is sealed by layer 2 and the remaining three burials (No. 179, 206 and 208) by layer 1. These four burials belonging to the later sealing levels yield remains of 11 individuals, including 4 infants/children, a juvenile and 6 adults (a female, 2 males and 3 of undeterminate sex). Interestingly, both the male specimens have evidence of pathological lesions (Lukacs *et al.* 1986). Positive diagnosis of cribra orbitalia (a non-specific infection) and iron deficiency anaemia have been reported for specimen No.168-A) while deformation of the vertebral column (spina bifida) is diagnosed for specimen 208-B. The remaining three 'adult' individuals (206-A/B/D) are represented primarily by dental/gnathic elements precluding any statement on their sex determination. It is less likely that a population which was not in a good state of health would be the target of the invading groups.

The occurrence of more than one individual in a burial indicating their simultaneous death could be better explained pathologically rather than culturally. Bio-cultural studies undertaken on the Inamgaon skeletal series (Walimbe and Tavares 1995) suggests higher morbidity rate in the later levels of occupation. Deteriorating climatic conditions, specially water scarcity, probably resulted in the recurrent prevalence of epidemics.

The end of the Deccan Chalcolithic culture cannot be adequately explained by a single reason. It is more likely that climatic changes coupled with the problems associated with increasing population pressures probably resulted in the decline of this culture.

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Book Review

Ray, H.P. and Jean François Salles (Eds.). 1996. *Tradition and Archaeology: Early Maritime Contacts in the Indian Ocean*. Delhi: Manohar. pp. 338. Price: Rs. 950.

The study of early maritime contacts in the Indian Ocean is a relatively less well researched field, and suffers from the disadvantage of a lack of dialogue among archaeologists, ethnographers, historians and anthropologists. The present collection of papers proposes to fill this vital gap and is "to be viewed as an attempt towards evolving a research strategy for a comprehensive study of seafaring in antiquity". Thus the emphasis is on finding a common meeting ground for the above mentioned disciplines in so far as ancient maritime contacts in the Indian ocean are concerned.

The authors have, within the broad perspective outlined above, set themselves an extremely ambitious task. They have sought to challenge the dominant "structure of Indian history and clearly indicate the continuity of seafaring activity in the Indian Ocean from the 4th century B.C. to the 14th century A.D. A word on what that precise dominant 'structure' of Indian history is will be in order. According to one of the editors (Ray: 8) historians have in the main concentrated on agrarian expansion, political decentralization, subjection of the peasantry and the emergence of the feudal polity. Ray wishes to 'challenge' this 'structure' in order to highlight the importance of seafaring and maritime activities from the 4th century B.C to the early medieval period. We shall come back to this rather interesting point later.

Not withstanding the above contention, the volume does cover a wide spectrum and a vast terrain. Ray's article gives an overview of maritime archaeology of the Indian Ocean. Within this context though, her explanation for excluding protohistoric maritime activities is not convincing — given that this was indeed crucial to the Indus/Harappan civilization which sustained it and therefore deserves more serious attention. Sedov discusses the archaeological evidence pertaining to Qana, the trading port on the south Arabian coastline. Kervan brings out the importance of Indian ceramic ware and its prominent representation in the Arab-Persian Gulf. The abundance of common coarse ware too is underlined by him. Bopearachchi in his interesting paper demonstrates the importance of studying the ports of the Sri Lankan isles to understand the changing horizons of, and fluctuations in trade. Macdowell's contribution to the study of Roman trade demonstrates the indigenous nature of the supposedly 'Roman' pottery. With Rajan's paper we move on to the southern coast of India where the evidence for maritime activity comes mainly from the Sangam texts. The recent data from archaeology substantiates this evidence and enlarges its scope. We also get interesting insights from the evidence from Thailand which corroborates the 'southern' data. With Subbarayalu we move on to the Arab and Chinese sources which relate to maritime trade with India during the medieval period. The observations on the Chinese ceramics are interesting. Sengupta's paper is mainly concerned with the definition of the term 'coast'. The paper primarily studies Bengal, and the hinterland connection of the Chota Nagpur plateau. Glover's paper is a rich documentation of early maritime contacts between India and southeast Asia. This in turn throws some light on the trading networks and the organisation of trade. With Rougeulle we move to the medieval trade network in the western Indian Ocean. The focus here shifts to the Persian Gulf and its radiating influence on the Red Sea and the East African coast.

With Manguin we move into the realm of ethnoarchaeology. This paper discusses ship building technology in the southeast Asian rim based on archaeological discoveries in the region. Deloche's paper carries forward the discussion on boat building activity. Here the emphasis is on the iconographic evidence from India spanning the period between the 2nd century A.D. and the 15th century A.D. Mcgrail details ship 'stitching' techniques, ancient as well as modern, to highlight the interdisciplinary nature of the study. Kently also discusses techniques of the sewn boats of the eastern coast of India, as further evidence of the multidisciplinary nature of the work.

Cooper's emphasis is on a rather neglected area of research, viz. the Andaman Islands and evidence of maritime contacts. Arunachalam draws attention to another neglected area, namely the traditional sea wisdom of Indian seamen. He gives a detailed disposition of the knowledge systems accumulated. Fatimi in the same vein discusses the 'Kamal', an instrument that measures the altitude of heavenly bodies — predecessor of the modern sextant.

Salles's paper, the last in the volume, is about Hellenistic seafaring in the Indian Ocean from the Arabian perspective. There are excellent individual contributions from a range of scholars in this volume but none of the contributors addresses the challenge that Ray talks about in her overview paper. On the contrary, these papers reinforce the 'structure' of history as discussed by historians from Romila Thapar to Burton Stein, rather than challenging the same.

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Obituary

Ramchandra V. Joshi
(1920-1997)

Professor R.V. Joshi, one of India's first geoarchaeologists and a former Joint Director of the Deccan College, Pune, died after a brief illness on 6th October 1997.

Born at Karjat, Maharashtra, he lost his father at the early age of five and had to struggle hard in his childhood. He was educated in Pune at Nutan Marathi Vidyalaya, and later at Fergusson College where in 1942 he completed his B.Sc. (Chemistry and Geology) with a first class . Subsequently he studied geology at Bombay University and in 1945 obtained his M.Sc. In 1946 he joined the Karnataka College, Dharwar as a lecturer in Geology and Geography, where he was associated with the renowned Professor C.D. Deshpande. In 1948 he had the opportunity of working with F.E. Zeuner, then Professor of Environmental Archaeology at the Institute of Archaeology, London. As a result of both inspiration from and subsequent training under Professor Zeuner, Joshi completed his Ph.D. (Pleistocene Studies in the Malaprabha Basin) under the guidance of Professor Sankalia in 1954. In the same year Joshi was appointed as the first Head of the Department of Geology, in the newly established Karnatak University in Dharwar, where guided by the late Professor K.V. Kelkar, Professor of Geology at Fergusson College, Pune, he developed his new department.

He was appointed Superintending Archaeologist in the Prehistory Branch of the Archaeological Survey of India in 1957 and during his 15 years of service he discovered a number of prehistoric sites in India especially in the regions of Hoshangabad, Wainaganga, Tapi and Banaganga. He also excavated the prehistoric cave site at Adamgarh in Madhya Pradesh. While still in the A.S.I. in 1961 Joshi did pathbreaking research in the Kathmandu valley, Nepal. He was invited by the French Government to study the prehistoric cave sites and in the same year — 1962 — represented India at the International Congress of Prehistory and Protohistory at Rome. In 1968 he was appointed as an Overseas Fellow for a year at Churchill College, Cambridge (England).

Dr. Joshi joined the Deccan College in 1972 as Professor of Prehistory. With his background in the earth sciences, chemistry and geography, he worked as a bridge between archaeology and the other sciences and was instrumental in setting up the various scientific laboratories at this Institute.

He excavated the Middle Palaeolithic site of Wadoli-Waghodi in the Godavari valley and discovered a number of prehistoric sites in the Manjra basin. Through the Indo-Polish Cultural Exchange Programme and the Academy of Sciences, Warsaw, he was invited to the U.S.S.R. in 1976 to deliver lectures on prehistory. He retired as Joint Director of the Deccan College in 1981. Professor Joshi was the only Indian prehistorian who was invited to write on the prehistory of South Asia in the UNESCO publication: "History of Humanity — Prehistory and the Beginnings of Civilization" (1994).

In memory of Robert Bruce Foote, the father of Indian Prehistory, in June 1995 Karnatak University held a national seminar at Bijapur and Professor Joshi was the chief guest since he was the successor to Foote's work in the field of geoarchaeology.

He developed a methodology for studying palaeolithic sites occurring in the alluvial deposits of allochthonous rivers like the Malaprabha (north Karnatak) and the upper Godavari (Maharashtra). He was the first Indian geologist to study Pleistocene deposits in the context of Palaeolithic artefacts. He departed from the traditional methods of interpreting past climate in terms of the gravels and silt deposits of the monsoonal rivers. He clearly showed that both these alluvial deposits could be an expression of the same climatic regime, stressing the importance of the seasonality of the strong flow of monsoonal rivers. His hypotheis of a humid climatic phase during the Middle Palaeolithic was based on the rarity of stratified Middle Palaeolithic sites in Deccan rivers due to a strong erosional phase.

Dr. Joshi's work in the Kangra basin, Himachal Pradesh set the pattern for glacial, climatic and geomorphological studies in the lower Himalayas of northeast India. He showed that the so-called morainic deposits of glacial origin were the product of strong rains and alluvial deposition of poorly sorted material on steep gradients during short lived episodic floods. He also established the presence of alluvial cone terraces of non-glacial origin in the Kangra valley.

Dr. Joshi made an important contribution to the prehistory of coastal Maharashtra (Konkan) and Kerala by establishing the presence of microlithic cultures in the context of sea level changes during the Holocene. Dr. Joshi's careful excavation of the rock shelter site of Pachad halfway up the famous Raigarh fort revealed pottery of a crude technology along with a large number of microliths made on chalcedony.

The major 1993 earthquake at Khilari (Latur District), Maharashtra has raised number of questions regarding the "stability" of the Deccan landmass. Though a number of geophysical investigations have been carried out in the last 3-4 years, there has not been any serious attempt at studying Quaternary deposits to establish the palaeoseişmic history of this region. It may be worth mentioning here that in the late 70s Dr. Joshi and his colleagues at Deccan College completed a project in the Manjra valley which indicated possible instability of this region during the Quaternary.

Dr. Joshi strongly felt the need for chemical studies of archaeological deposits to provide additional information on stratigraphy, settlement patterns, human activity areas and related ecological problems which till the 70s had been based largely on the physical composition of archaeological debris and associated cultural material. The result was that two dissertations were completed under his guidance. The first was by B.C. Deotare on anthropogenic soils from prehistory to history and the second by A.A. Kshirsagar on fluorine analysis of bones from prehistoric sites. Archaeological chemistry of soils and fluorine-phosphate analysis of bones have assumed an important role in scientific archaeological research in India. Two of Dr. Joshi's other Ph.D. students are now in academic positions in Kerala and Madhya Pradesh.

A scholar of eminence , Professor Joshi led a very simple life devoting himself to academic pursuits. He was known for his warm and generous nature and encouraging attitude towards his students. In fact, his simplicity was reflected in his informal approach while dealing with various problems and different people. He was a disciplined administrator, a respected teacher and above all a kind and generous human being. By virtue of his dedication and self-discipline he led a happy and contented life. His demise is a great loss to scientific archaeology but his contribution to the subject will be remembered for many years to come.

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Obituary

Shashi Prabha Asthana
(1947-1997)

The death of Dr. Shashi Prabha Asthana on 26th September 1997, after a prolonged illness, at the young age of fifty, is an irreparable loss to South Asian Archaeology and Museology as well as to her numerous friends and admirers. Born in Hardoi, a district town in Uttar Pradesh, Shashi had a brilliant educational career, passing her M.A. in Ancient Indian History from Lucknow University in 1965 and earning her Ph.D. degree from the Magadh University in 1976. Besides, she obtained a Certificate of Proficiency in French from Lucknow University in 1966; a Diploma in German from Max Mueller Bhavan, New Delhi in 1974; and a Certificate of a short-term course in Museology from the National Museum, New Delhi, in 1973. Shashi was the recipient of a string of scholarships and fellowships which included the Bursary Scholarship of Lucknow University (1963-65); U.G.C. Junior Fellowship (!967-70); Commonwealth Post-Doctoral Fellowship for research in West Asian archaeology at the Institute of Archaeology, London University (1976-77); Short-Term Fellowship (October-November 1977) of the British School of Archaeology in Iraq for field work in Iraq; Short-Term Fellowship (December 1997) for field work in Iran; and J.D.R. 3rd Fund Fellowship (1978) for studying Indian art and archaeology collections in various museums in the United States.

Shashi did her Ph.D. thesis on the history and archaeology of India's contacts with other countries from earliest times to the 3rd century B.C. using data from both library and museum sources. She participated in explorations and/or excavations at Bhansari in Uttar Pradesh; Bhimbetka in Madhya Pradesh; in Seistan, Kirsan and Khuzistan in Iran; and around Babylon, Kish, Ur, Uruk and Nimrud in Iraq. She studied a wide range of art and archaeological collections in the following museums: the Stein collection from Fars (Iran), and Mesopotamian material in the British Museum; Bampur (Iran) material in the City Art Gallery at Birmingham (U.K.); Shahr-i-Sokhta material in the National Museum of Oriental Art, Rome; Mesopotamian material in the National Museum at Baghdad; Shahdad material in the Iran Bastan Museum at Teheran; the Indian art collection in the Metropolitan Museum of Art, New York; Baluchistan material in the American Museum of Natural History, New York; the Indian art collection in the Brooklyn Museum, the Cleveland Museum of Art and the Los Angeles County Museum; and Khuzistan material in the Oriental Institute at Chicago.

Shashi began her professional career as a Technical Assistant (Registration) in the National Museum, New Delhi (1972-79), and was successively promoted as Deputy Keeper, Pre-Columbian and Western Art (1979-81); Keeper (Archaeology 1982-92); and finally as Assistant Director (Administration) which post she held until her premature demise. Had she lived till the age of 58 years (the age of superannuation for Government officers), there is little doubt that, given her professional competence, dedication and integrity, she would have certainly reached the top of the professional ladder.

As a responsible officer of India's National Museum, Shashi contributed, in varying capacities, to the organisation of the following national and international exhibitions of India's cultural heritage:

National: (at the National Museum, New Delhi): Acquisition of West Asian and Southeast Antiquities, 1975; Pre- and Proto-historic Indian Antiquities, 1976; Krishna in Indian Art, 1982; Sports and Games in Ancient India, 1982; Masterpieces of South Indian Bronzes, 1983; Rare Indian Sculptures, 1984; Indian Sculptures through the Ages, 1985; Kushana Sculptures from Sanghol, 1985; and Recent Archaeological Discoveries, 1986.

International: Indian Art Exhibition, Paris, 1978; Manifestation of Siva, Philadelphia, 1980-81; Thracian Art, 1981; Festival of India, London, 1982; Indian Art, Japan 1984; Indian Sculptures through the Ages, Washington, D.C., 1985; Rasas in Indian Art, Paris, 1986; Essence of Indian Art, San Francisco, 1986; Indian Art through the Ages, Moscow and Leningrad, 1987; Silk Road, Nara, Japan, 1988; Art and Culture around 1492, Spain, 1992; Indian Art, Berlin, 1992; Indian Bronzes: Hungary 1992, Italy 1993; and Alamkara Singapore 1994.

Even though in her professional career in the National Museum in New Delhi, Shashi was called upon to shoulder a variety of academic and professional responsibilities, her true love was Indian archaeology, and she devoted all her spare time to research and publications on this subject. She published four books and over thirty research papers on Indian art and archaeology in national and international journals and edited volumes. She participated in the editing of three books, and presented research papers at a number of national and international conferences, seminars and symposia. Besides, she taught Egyptian art to post-graduate students of the National Museum Institute (Deemed to be University) for four semesters, and over several years delivered lectures to students of inservice training courses in Museology conducted at the National Museum.

As a person, Shashi was the embodiment of charm, humility, an unassuming nature, courage and hospitality. For many years her small house served as the office of the Indian Archaeological Society until the Society was able to acquire its own building. Her office and home were open to all archaeologists - old as well as young - and she always welcomed them with snacks, tea, coffee, lunch and dinner, even when her health was not all that good. She had a large number of friends and admirers among archaeologists in the country and abroad. She always smiled, even while she suffered excruciating pain for over two years during periodical dialysis at the All India Institute of Medical Sciences because of her kidney ailment. Finally, she was able to get a kidney transplant and we all thought her days of agony were over and that she would be able to live her normal span of life. Sadly her end came suddenly and unexpectedly, and most unfortunately in the absence of Dr. S.P. Gupta who was away in Italy and whom she always considered her guide and mentor. She will be greatly missed.

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Man and Environment

Journal of the
Indian Society for
Prehistoric and Quaternary Studies

Volume XXIII, Number 1 (January-June 1998)

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Editorial

This issue of the Journal contains, besides other papers, three invited contributions — the sixth Professor H.D. Sankalia Memorial Lecture by Professor A.K. Narain, delivered at the XXIV Annual Conference of the Society held at New Delhi in November 1996; the seventh Professor H.D. Sankalia Memorial Lecture by Dr. Raymond Allchin, and the Presidential Address by Dr. Bridget Allchin, both delivered at the Society's XXV Conference held at H.N. Bahuguna Garhwal University, Srinagar in October 1997.

Professor Narain is a senior and distinguished historian and archaeologist with a long career at Banaras Hindu University, and the University of Wisconsin-Madison (U.S.A.). Bridget and Raymond Allchin, of the University of Cambridge (U.K.), have devoted more than four decades to the study of South Asian archaeology, the former specialising in hunter-gatherer prehistory and ethnoarchaeology, and the latter in protohistoric and early historic archaeology. They have been prolific writers and have produced several excellent syntheses of South Asian archaeology which are extensively used by researchers and students alike. Raymond Allchin's interest also extends to medieval Hindi literature, having translated the works of Tulsidas into English. They are genuine admirers of the culture and people of South Asia, and through their publications have made the early past of South Asian countries widely known. They have many friends among the historians and archaeologists of India, Pakistan, Sri Lanka and Bangladesh. Through the Ancient India and Iran Trust, established by them at Cambridge in the mid-eighties, they have provided an opportunity to scores of young South Asian archaeologists to visit Cambridge and other academic centres in Europe and interact with fellow scientists.

The issue also contains Dr. Dilip Rajgor's paper which was chosen for the H.D. Sankalia Young Archaeologist Award. Dr. Rajgor is not a professional archaeologist and therefore his winning this prestigious award and the research he has carried out on the subject are all the more creditable.

The XXVI Annual Conference of the Society will be held under the auspices of the Department of Ancient History, Culture and Archaeology, University of Allahabad, Allahabad 211 002, from 16 to 18 November, 1998. Readers interested in participating in the Conference are advised to contact Drs. J.N. Pandey and J.N. Pal, Organising Secretaries, at the above address. We hope that members of the Society will participate in the Conference enthusiastically.

The publication of this Journal has been financially supported by the Indian Council of Historical Research (ICHR) and Archaeological Survey of India (ASI). The responsibility for the facts stated, opinions expressed, or conclusions reached is entirely that of the contributors of the articles. The ICHR and ASI accept no responsibility for them.

From Ordos to the Oxus: the Tokharians and their Odyssey*

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Varanasi 221 005

The Tokharians known also as *Tukhāra* with the variants *Tuhkhāra/Tushkāra* in classical Sanskrit literature[1], are one of the multiple peoples who formed a part of the melting pot of the history and civilization of South Asia. Their impact on world history has been indelible, but their own history has suffered by default like that of all those others who who did not write their histories.

In the Puranas and the Epics, the Tokharians are listed along with the Yavanas, Sakas, and Pahlavas as outlandish people. However, the amount of information we have about them in these sources is comparatively very meagre, much less than what we have even about the Yavanas and the Sakas. For example, in the *Mahābhārata* we learn about them only briefly as bringing tributes to Yudhisthira, and their presence is noted as soldiers in the army of Duryodhana at his Rājasūya and as among those who were vanquished by Arjuna (Sorenson 1963: 683-4). In the Puranas we are informed that among the various lineages of kings which followed the Andhras there were fourteen *Tukhāra* (Pargiter 1962: 44-47, 72) kings ruling for an unbelievable 7000 or 500, years, but the numbers may reasonably be corrected as 107 or 105 (Pargiter 1962: 72). By the time of Kalhana they seem to have been confused with the Turushkas, for in the *Rajatarangini* the Kushanaa kings, Kanishka, Juskha and Hushka are called Turushka (*Rājatarangini* 1.168-70). This is specially noteworthy because the Kushanaas of South Asia, in their inscriptions and coins never called themselves *Tukhāra* or *Turushka*. In the Chinese annals too, the Guishuang (**a**), i.e. the Kushanaas, known as one of the Yabgus (*hsi-hou*) (**b**) of the Yuezhi (**c**) (=Tokharians), chose to call themselves Guishuang, not Yuezhi. But the Chinese still insisted on calling them Yuezhi[2]. It is clear and significant that Indian literary sources, like the Chinese and the Graeco-Roman, recognised the identity and importance of the broader category of the Tokharian (Yuezhi) people and not of their Kushana kin[3].

That the Tukharas were known as Yuezhi in the early Chinese accounts is now as well known to modern scholarship as it was to Kumarajiva[4]. In the latter half of the first millennium A.D., when more than one dialect of the Tokharian language was known to have been spoken in the various oases city states on the northern silk route of eastern Central Asia, their ethno-linguistic geography had already expanded on account of their movements and the distribution of settlements. From the middle of the first mllennium A.D. the Tokharians were already known as such, or by phonetically similar names in the languages of the various peoples they became known to (Bailey 1947, 1948: 26-53; 1935-37: 883ff); and the Chinese also started calling them Tu-huo-la (**d**)[5] apart from their hetronym Yuezhi.

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[*] The sixth Professor H D. Sankalia Memorial Lecture was delivered at the XIV Annual Conference of the Indian Society for Prehistoric and Quaternary Studies, New Delhi, 24-26 November 1996.

[1] It is often spelt as *Tushara* which means "snow, cold" etc., *Tukhāra/ Tushkāra* on the other hand are referred to as a people living northwest of Madhyadesa in *Atharvaveda Parisishta*, in the epics *Rāmāyana and Mahābhārata* and in the *Puranas*; Tukhara in a later work *Vikramankadevacarit* (ix.116, xviii 93) refers to a Tukhara horse (Monier-Williams 1899: 449)

[2] *Hou Hanshu*, 118 9a See Zürcher's translation (1968 367) — "In the various (Western) countries (their ruler) is always referred to as 'the king Kuei shuang', but the Han, basing themselves upon the old appellation, speak about the great Yuezhi".

[3] It is in *Yavanajataka* that there is a reference to the Kushanas (Pingree 1978, Narain 1995 35-36).

[4] Bailey (1970 121-22, 1947, 1948· 126-53), "Kumarjiva (born in 344), translates *tukhara* through a native of Kuci not acknowledging that the name *tukhara* applied to either Kuci, or Agni . " (Bailey 1935-37: 883ff)

[5] See for example Xuan Zhang's account, *Si-yu-ki* Translation by Walters (for other references see Bailey (1935-37 883ff).

Although the available written documents of the Tokharian language are datable only from about the middle of the first millennium A D. the antiquity of the language and its classification as an Indo-European language of the so-called "Centum" group have never been doubted. However, discovery of their linguistic documents, all in modern Xinjiang, has been annoyingly baffling to many Indo-Europeanists, particularly to those who were committed to an European or Western homeland of the parent Indo-European people, the so-called Aryas. This is because it disturbs the hitherto very neat geographical division of the "centum" and "satem" languages. All the other "centum" language speakers, like the Greeks are located in the West, with the Tokharians surviving as a lone island amidst the sea of "satem" language speakers.

I will refrain here from discussing the linguistic and other issues related to Tokharian and its significance in the Indo-European, or the so-called Aryan, problematics because of time and space limitations. Surely the issues are not dead; but for me it appears something like the saying "the king is dead, long live the king." And to update on the issue I cannot help drawing attention to recent exciting discovries of a large number of the so-called "mummies" in Xinjiang, which have brought the Tokharians and the Indo-European homeland issues once again into the limelight. An international conference held in April 1996 in the USA, discussed these discoveries and their implications[6]. Victor H. Mair stated in the abstract of his paper· "What is particularly remarkable about these corpses is that, in terms of their physical characteristics, they are clearly Caucasoid or Europoid, especially before about 500 B.C. when the Mongoloid peoples begin to show up on the eastern fringes in increasing numbers. The implications of these early peoples of the Tarim Basin for the history of Eurasian civilization are enormous. Their accurate identification will almost certainly lead to a better understanding of such problems as the origins of the Indo-Europeans, the introduction of the domesticated horse and wheeled vehicles to East Asia, and the transmission of bronze across Eurasia." He described the international multidisciplinary research project that he organised to study the corpses and their culture, focusing on new evidence likely to be obtained e.g. from DNA and textile analyses. The groundwork for this conference had already been prepared by Mair and others with articles and exclusive photographs published in such popular scientific magazines as *Archaeology* (Mair 1995: 28-35), *Discovery* (Hadington 1994: 68-77), *Science News* (Bower 1995: 113-28), *National Geographic* (Allen 1996: 44-51), etc. This took place before objective scholarly opinion came to grips with the problems arising out of these discoveries, in favour of the European homeland of the Indo-Europeans and significantly also of the Western impact on the origins of Chinese civilization by branding these "mummies" as Caucasoid or Europoid[7]. Be that as it may, permit me to justify this little digression, which is not altogether unwarranted, because to the best of my knowledge I have not come across any response from colleagues in India, particularly now when I notice that the discussion on the Aryan homeland issue is so alive here. I would urge our scholars to study the new discoveries in a broader perspective and our molecular and cellular biologists, particularly, to examine the DNA input in determinning the physical types represented by the corpses because much has already been made out of it.

As for myself, I find not only evident weaknesses and obvious presuppositions in the West-oriented theories on the Indo-Europeans but also feel convinced that the time has come when, with the end of the twentieth century, we should be ready finally to bury, or cremate if you like, the phantom of the so-called Indo-European, or the Aryan, as **the** single parent race: there never was such a race. This is a mental product of the linguists and they should be allowed to play with it without unnecessary interference in their investigations. I do not believe we can argue from language to race for the simple reason that languages have been, and are being adopted and adapted from one race to another as a result of interaction. Instead of futile searching for an absolutely single or primary race, whatever name you want to give to this X, it would productively advance our knowledge of human history if we objectively study the origins and movements of individual peoples and their interactions as "independent" case-studies without such constraints as of the "nation-state" or for that matter any other[8].

From the information I have, let me add that more than eighty persons attended the Conference and more than forty papers were presented. Twelve of the invitees, including me, could not attend the Conference and read their papers of which abstracts were circulated Among these twelve absentees there were seven from China, one from Hong Kong, two from Kazakhastan, one from Germany and myself, the sole invitee from India.

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[6] A conference on the Bronze Age and Iron Age Peoples of Eastern Central Asia was held at the University of Pennsylvania Museum of Anthropology and Archaeology, Philadelphia, Pennsylvania, April 19-21, 1996 I was one of the invitees but unfortunately I could not participate in the conference for health reasons But see the abstract of my paper entitled "On the Tokharian/Yuezhi and the Mummies from Qizilchoqa" on p 16 of the abstracts published on the occasion

[7] Note such titilating sub-titles of these popular articles, cover advertisements with exclusive illustrations etc , as the summary statement, "In the dry hills of this Central Asian province archaeologists have unearthed more than 100 corpes that are as much as 4,000 years old, astonishingly well preserved — and Caucasian" (my underline) for the article "The Mummies of Xinjiang", the cover of the magazine *Discovery* displays a photograph of one of the corpes with a caption note as, *"Riddle of the Chinese Mummies What are 4,000-year-old Caucasians doing in-Xinjiang?"*

[8] For my views on history without boundaries see Narain (1968: 19)

Conspicuous by his absence was Wang Binghua, Director, Xinjiang Institute of Archaeology, who had the pioneer role in the discovery of these mummies and the abstract of whose paper was very informative. So also Lu Enguo from Urumqi, another archaeologist who examined the cemeteries of the Charwighul culture. It is clear from the abstracts of these two papers, that by and large the Chinese archaeologists with first hand information about the desiccated corpes are not so euphoric or romantic about their discoveries as Mair and others are about the Caucasian identity of the mummies.

To the best of my knowledge, perhaps for the first time, DNA studies were made use of in clinching the Indo-European issue. In his popular articles and oral presentations Mair had already emphasized the contribution of the preliminary results of DNA studies like that of Paolo Francalacci in favour of his Europoid theory. But Professor Emeritus Luigi-Luca Cavalli-Sforza of Stanford in response to his own question "... can genetics help to understand the relevant historical problems?" admitted that "... there are difficulties with testing ancient remains but some useful information can always be obtained from living populations."

Among other well known scholars who attended the Conference were Colin Renfrew, James Mallory, Denis Sinor, Elena Kuzmina, Asko Parpola, Edwin Pulleyblank, Ed. Shaughnessy and Werner Winter. Among the archaeologists from China who had participated in unearthing these corpses perhaps only one, Dolkun Kamberi, an Uighur from Urumqi, and a research student of Professor Mair, in presenting his paper, appears to have kept his option open. The impression one receives from the titles of the papers and their abstracts is that no commitment can be made with any degree of confidence, and the identity of at least some of the physical types represented by the corpses dated to periods earlier than 500 B.C. remains as enigmatic as the Tokharians themselves. Only one thing is certain and that is that the territorial identity of the sites where the corpses have been found is the same as that where the later linguistic remains of the Tokharians have been found. Also that, this territorial definition fits in well with the evidence so far available in the Chinese historical annals about the original location of the Tokharians and the westward direction of their movement Further, if one examines the totality of more than three to four hundred desiccated corpses of men, women and children dating from about 1800 B.C. to almost the beginning of the Christian era what is confirmed is that the population of this corridor region of Xinjiang was of mixed heritage.

To return to the specific topic of my present lecture, it should suffice, as a background, to draw your attention to my earlier statements in *Man and Environment* (1987) and also to on the "First" Indo-Europeans: the Tokharian-Yuezhi and their Chinese homeland. But to restate my position briefly I would like to bury, or cremate, the Indo-European, or for that matter Aryan, racial parentage and their original homeland issue — gift of colonial-era scholarship — and rather examine each and every people, as an individual case-study and discuss their movements and interactions in history. For me *Arya* is a cultural concept and not a racial identity. it was a synonym for the "civilized" against the "barbanian", and where the "other" was always the "barbarian". Thus, the authors of the Vedic civilization were no doubt Aryans, speakers of one of the so-called Indo-European languages, and they did not **have to** come from somewhere else, they could very well be the offspring of the soil or nearby areas: as were the Greeks, the Tokharians, the Sakas and many others. They were not static, they moved and they interacted as part of the process of human history.

To wind up, the Tokharians originally lived close to Ordos, near the upper bend of the Yellow River, and in Gansu. They were essentially a dominant oases people, powerful in the region, **until** the end of the third century B.C. when they yielded to the increasing might and pressure of the Xiongnu (**e**). Finally, their ruling clans, known as Da Yuezhi (**f**), the Great Yuezhi, were forced, after an ignominous defeat at the hands of the Ziongnu, in the second century B.C. to leave their homelands and start moving westward in order to relocate themselves. And thus started a long odyssy of momentous consequences to world history in general and South and Central Asia in particular.

This odyssey of the Yuezhi traversing a geography of challenging terrain is as obscure as it is fascinating. With it begins the epic of a great period of world history. The movement which brought the Yuezhi to the Amudarya in the 2nd century B.C. probably started somewhere near the noethern bend of the Huanghe. This was divided into two phases. The first, which took them from their homelands to the Upper Ili region and the second, which took them from the Upper Ili across the Syrdarya to the northern bends of the Amu. The nucleus of the Yuezhi habitat, until driven away by the Xiongnu was no doubt the region along the foot of the Nanshan, where a number of streams flowing from the mountains to the steppe support fertile oases. It is significant that in their later movements and preferences also the Yuezhi remained oasis people rather than steppe nomads (Lattimore 1953: 456).

Now, the Great Wall of China was a monument of magnitude not only for Chinese history but also of abiding importance for the history of the world. It enabled the Qin (**g**) king Shi Huangdi (**h**) to become the first emperor of a unified China. While it forced the Xiongnu to migrate away to the north, it also led them to unify "all the people who live by drawing the bow". This was natural A wall does not provide a territorial imperative for the insiders only but also a divide for the outsiders. If an empire was made inside the wall, there was nothing to stop the making of another outside the wall. There was left no option for the Xiongnu, a steppe people, who were accustomed to live by their periodic depredations in the agricultural areas of Huanghe, but to ultimately establish their hegemony over the oasis peoples of the marginal areas. Whether the Great Wall was a product of "nomad pressure" or of "Chinese growth" the results were clear enough, and of momentous consequences to world history (Lattimore 1953: Chapter XIV, 460-61).

When Qin Shi Huangdi was conquering China, and Touman (**i**) was the *ShanyL* (**j**) of the Xiongnu, the Yuezhi were flourishing as a powerful and prosperous people, they could afford to despise the Xiongnu (*Shiji* 110-56, Watson, 1961: 60; *Qian Hanshu*, 96 A.15A; Hulsewe and Loewe, 1979: 120). Unable to hold out against the Qin forces Touman had withdrawn to the far north, "where he lived with his subjects for over ten years". But when, after the death of Meng Tian (**k**) China was once again plunged into a period of strife, turmoil and conflicts, the Qin forces sent to the northern borders to garrison the area, had all returned to their homes, the Xiongnu once again began to infiltrate south of the bend of the Huanghe until they had established themselves along the old border of China. Naturally, at this time Touman could ill afford hostility from the Yuezhi and initiated a policy of appeasement by sending his eldest son, the heir apparent, Maodun (**l**) as a hostage to them. But Touman had two objectives in mind: he wanted to clear the succession for his favourite younger son by getting rid of Maodun as well as to buy the friendship of the Yuezhi. He was impatient. After Maodun had arrived among the Yuezhi, Touman made a sudden attack on them. The Yuezhi were about to kill Maodun in retaliation, but he managed to steal one of their best horses and escape, eventually making his way back home. Struck by his bravery, Touman had no option but to put him in command of a force of ten thousand cavalry. Maodun gradually consolidated his power and having collected around him a band of trusted followers, he shot his father dead by a whistling arrow (*Mingo.* **m**) and then executed his step-mother, his younger brother and all the high officials of the "nation" who refused to take orders from him, and set himself up as the new *Shanyu*.

At first Maodun followed a policy not only of friendship with, but also appeasement of his neighbours as is clear from his dealings with the powerful Eastern Barbarians, the Donghu (**n**) as given in the *Shiji* (*Shiji* 110, Watson 1961: 160). But when the ruler of the Eastern Barbarians wanted possession of a wasteland between his territory and that of the Xiongnu, and Maodun was even advised by his ministers to yield, the latter flew into a rage saying "Land is the basis of the nation" (*Shiji* 110, Watson, 1961: 162). Not only did he then execute all the ministers who had advised him to give in, but he "mounted his horse and set off to attack the Eastern Barbarians, circulating an order throughout his domain that anyone who was slow to follow would be executed" (*Shiji* 110, Watson, 1961: 162).

The Eastern Barbarians, the Donghu, being unprepared, were defeated and conquered in this one campaign. Then he returned and rode west, attacking and routing the Yuezhi, and annexed the lands of the ruler of Loufan (**o**) and the ruler of Boyang (**p**) south of the Huanghe. Thus he recovered possession of all the lands which the Qin general Meng Tian had taken away from the Xiongnu: the border between his territory and that of the Han emperor now followed the old line of defences south of the Huanghe. In his letter to the Han Emperor Wen (**q**), Maodun stated in 176 B.C. that he had "succeeded in wiping out the Yuezhi, slaughtering or forcing to submission every member of the tribe" (*Shiji* 110.106; Watson 1961: 168; Qian Han-shu 94A.11a). This may have been an over-statment when it was made, but certainly this was the beginning of the end of the Yuezhi power in their homeland. They had despised the Xiongnu, but the tables had been turned and now they stood vanquished. This was a great success indeed for the Shanyu so much so that the Chinese thought that "he cannot be attacked", and the Emperor thought it far better to make peace with him.

Shortly afterwards Maodun died. His son Jizhu (**r**) was set up with the title of *Laoshang* (**s**). Continuing his policy of peace and appeasement, Wen sent a princess of the imperial family to be his consort. Riding on a wave of victory, the Xiongnu did not want to take any chances. The Great Wall as well as the appeasement policy of the Chinese did not prove to be a compelling enough reason for the Xiongnu to stop their aggressive designs and depredations for these were not only integral to their life style but were imperative for their existence on account of geographic and climatic factors. In 166 B.C. Jizhu "led a force of one hundred and fifty thousand horsemen through the Chaona (**t**) and Xiao (**u**) passes. Killing [Sun] Ang (**v**), the chief commandant of Beidi (**w**) province, and carrying off large numbers of people and animals". Eventually he rode as far as Pengyang (**x**), sent a surprise force to break into and burn the Huizhong (**y**) palace, and despatched scouts as far as the palace of Ganquan (**z**) in Yong (**aa**), bringing them within sight of the capital Changan (**ab**). Consequently Emperor Wen sent Jizhu a letter in 162 B.C., asking for peace (*Shiji* 110; Watson 1961: 173).

Having impressed his might on the Chinese, Jizhu was free to turn his attention in other directions. He had not forgotten the Yuezhi, who were still living close to the Xiongnu and had been very powerful only a decade ago. It would have been foolish on the part of the Xiongnu to do so for they formed a potential ally of the Han. Soon after, therefore, an encounter took place between them, the details of which are not known. But it is reported by Sima Qian that the Xiongnu killed the king of the Yuezhi and made his skull into a drinking cup (*Shiji* 123, Watson 1961: 264, 268, *Qian Hanshu* 96A.15A: Hulsewe and Loewe 1979: 120).[9]

The great core of the Yuezhi, perhaps the dominant group, known as the Da Yuezhi, the Great Yuezhi, moved westward. "A smaller number of their people, who were unable to make the journey west, sought refuge among the Giang (**ac**) barbarians in the southern mountains, where they are known as the Xiao Yuezhi (**ad**), the Lesser Yuezhi" (*Shiji* 123, Watson 1961: 268, see *Qian Hanshu* 96A.15A, Hulsewe and Loewe 1079: 121).[10] A few perhaps dispersed out in other directions, living precariously until they reappear in later history within the wider boundaries of their original location (Pulleyblank 1966: 18-19; Haloun 1949: 119-38).[11]

Undaunted by the calamity that had befallen them, the Da Yuezhi made the widow or the son (*Shiji* 123.2a, Watson 1961: 265, *Qian Hanshu* 61.2A, Hulsewe and Loewe 1979: 208) of the king, killed by Jizhu, their ruler and set out for the West, "beyond Dayuan, where they attacked and conquered the people of Daxia and set up the court of their king on the **northern** bank of the Guei (**ae**) River i.e. Oxus" (*Shiji* 123, 3.6; Watson 1961: 268, Zurcher 1968: 360; Enoki 1959: 129, *Qian Hanshu* 96A.15, Hulsewe and Loewe 1979: 121). Unfortunately, the source which could have given much information on the Yuezhi and their movement does not even mention the name of the king whose skull was made into a drinking cup by the Xiongnu nor that of his widow or son, who led the Yuezhi on their arduous journey to the far west. But, Sima Qian was writing a history of China and not of the Yuezhi. For the understanding of Chinese history it was more important for him to go into the details of the Xiongnu, an enemy next door, rather than into the history of a distant people who could be a potential ally but who refused to oblige the Han emperor and his emissary Zhang Gian (**af**), the main source of Sima Zian.

The Yuezhi were a powerful and prosperous people, spread over a large area. Economically they did not live so tenuously as the Xiongnu: they were essentially an oasis people and did not belong to the open steppe region as the Xiongnu did. They were admired for their horses and jade and were powerful but not unnecessarily or habitually aggressive. They had friendly relations with the Chinese in the past and they were friendly and unobtrusive also to their neighbours in the west, most of whom probably owed allegiance to them and belonged broadly in the same ethno-cultural group as the Yuezhi. The Yuezhi occupied a viable region: a corridor area which witnessed significant movements of people and of trade, which remained the case until much later times. Ethnic and cultural similarities and friendships as well as economic interdependence, and their old prestige and influence, probably made the movement of the Da Yuezhi easier over a considerable area of the west. Surely, this movement was not just one straight march across the whole region but one which was made in stages and which must have taken more than a decade at the least.

While the Yuezhi were thus on move, the *Laoshang* Jizhu had been succeeded by Junchen (**ag**) (*Shiji* 110: 123, *Qian Hanshu* 96A, ?). In spite of Emperor Wen's offer of renewal of peace alliances, the Xiongnu invaded the Shang (**ah**) and Yunzhong (**ai**) counties. All attempts at friendship and peace with the Xiongnu, whether by appeasement or by ruse, failed, and the Xiongnu broke with the Han and attacked the border defences wherever they happened to be. Time and again they crossed the frontier and carried out innumerable plundering raids. It became necessary for the Han to make a concerted effort to destory the Xiongnu.

This was not an easy task. They needed a strong ally with a common hatred for the Xiongnu. They knew what had happened to the Yuzhi, who bore a constant grudge against the Xiongnu, and had been unable to find anyone to join them against their enemy. Emperor Wu di (**aj**) (40-87 B.C.) decided to try to send an envoy to establish relations with the Yuezhi and he sent out summons for men capable of understanding such a mission. Zhang Qian, who had been a Palace Gentleman (or Palace Attendant) between 140 and 135 B.C., answered the summons and was appointed as envoy[12]. However, by the time Zhang Qian set out, probably in 136 B.C.,[13] it was already late. For the Yuezhi, who had remained not far away from the Xiongnu (probably waiting for some initiative and overtures from any direction to help avenge their discomfiture) had already moved still farther in their westward trek, because no meaningful offers of help were forthcoming and they did not want to take any risk in that difficult period of their history.

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[9] Some scholars have preferred to translate the word as "the bowl" instead of drinking cup" or "drinking vessel"

[10] Enoki (1959 230) believes that since the Yuezhi were originally rulers of the Xiang the Lesser Yuezhi did not ask for their protection but maintained themselves with them who were their subjects.

[11] Enoki (1959 230) does not consider the region between Dunhuang and Gansu as the only territory the Yuezhi held. Their headquarters may have been there but they ruled over "the greater part of the Mongolian plain, possibly Zungaria, the north of Tienshan where the Wusun lived, countries in the Tarim basin and the upper waters of the Yellow River

[12] That is, during the period of Jianyuan. See *Shiji* 123, Ia, Zurcher (1968. 359), Hulsewe and Loewe (1979· 207) Zurcher gives the equivalent of Jianyuan era as 140-134 B.C

[13] See Zurcher (1968 359) "traditionally 139-38B, C., probably not before 133 B C"; Hulsewe and Lowe, 1979: 209, in 774, "it is traditionally assumed that Zhang Qian started on his journey in 139 or 138 B C But this is contrary to the evidence that only in 133 B.C. the first measures against the Xiongnu were considered, see e.g. Hanji II.5aa for the year 133 (Yuanguang 2, tenth month, or slightly later)". But Hulsewe and Loewe have also noted that the only absolutely certain dates of Zhang Qian's journey is the year 123 B C when sometime after his return he was given a nobility, Zurcher has also this date in mind If this is true we cannot accept the traditional date of Zhang Qian's starting in 139-38 B.C. because we must allow "over ten years" detention in Xiongnu camp plus "over a year" in the region of Da Yuezhi and Daxia plus the time he took in journey and stop-overs in Dayuan, etc If we allow at least thirteen years for the whole period he may have started in 136 B C He should have reached his destination among the Da Yuezhi by 136 11=125 B.C. and was back in China by 123 B.C.

We learn from the biography of Zhang Qian (*Shiji* 123.Ia.m *Qian Hanshu* 61).[14] that he set out from Longzi (**ak**), accompanied by Ganfu (**al**), a Xiongnu slave,[15] and travelled west through the territory of the Xiongnu — to which probably there was no alternative. The two were captured by the Xiongnu and taken before the *Shanyu*. . "The Yuezhi people live north of me" *Shanyu* said. ,What does the Han mean by trying to send an envoy to them? Do you suppose that if I tried to send an embassy to the kingdom of Yue (**am**)[16] in the southeast, the Han would let my men pass through China?" he added. The Xiongnu detained Zhang Qian for over ten years and gave him a wife from their own people, by whom he had a son. But Zhang Qian bided his time, kept his imperial credentials safe and managed to escape and resume his journey toward the Yuezhi with his party. After hastening west for twenty or thirty days, they reached the Kingdom of Dayuan. "The king of Dayuan, who had heard of the wealth of the Han empire and wished to establish communication with it, gave Zhang Qian guides and interpreters to take him to the state of Kanhju (**an**). Whence he was able to make his way to the land of the Great Yuezhi." This itinerary indicates clearly that while Zhang Qian spent about ten years with the Xiongnu, the Yuezhi had already moved beyond Dayuan and Kangju. The widow or the son who had succeeded the Yuezhi king killed by Jizhu had already arrived and settled in the region north of the Amudarya: this must have been the position in c. 125 B.C.

This nameless ruler of the Da Yuezhi now ruled over a region which was rich and fertile and seldom troubled by invaders, and the ruler felt safe and happy. The Yuezhi considered the Han too far away to bother with and had no particular intention of avenging their king's death by attacking the Xiongnu. Certainly it was more important to deal with the new neighbours in the west and establish the new state than to return east to help the Han From the court of Yuezhi, Zhang Qian travelled on to the state of Daxia but in the end he was never able to interest the Yuezhi in his proposals. After spending a year or so in the area, he began to journey back along the Nanshan or southern mountains, intending to re-enter China through the territory of the Jiang barbarians, but he was once more captured by the Xiongnu and detained for over a year (*Shiji* 123, Watson 1961: 265; *Qian Hanshu* 61, 2B, Hulsewe and Loewe 1969: 209). Just then the *Shanyu* died and as a result of the turmoil he was able to escape and return to China in c. 123 B.C. with his Xiongnu wife and the slave Ganfu. The Emperor honoured him with the post of Palace Counsellor, and awarded Ganfu the title of Fengshigun (**ao**), Lord-Who-Carried-Out-His-Mission (*Shiji* 123, Watson 1961: 266, Hulsewe and Loewe 1969: 209). China thus failed in this first political mission abroad but succeeded in opening up a big world for itself. If the Great Wall of China provided the territorial imperative and glory in isolation for the Chinese empire, the Zhang Qian mission made China participate in world history. And these two events are not altogether unrelated.

Now the geography of the Yuezhi movement needs to be considered. Unfortunately the information available is not so precise as one would wish. Not only are the old Chinese names baffling but there are also inconsistencies in the descriptions, directions and distances as given in *Shiji* and *Qian Hanshu*.

Chinese sources are unanimous in reporting that the Da Yuezhi went beyond the Dayuan. Zhang Qian passed through his kingdom in order to reach the Yuezhi.[17] Therefore the location of Dayuan is crucial to the problem. Was this the name of a territorial state or merely the ethnic name of a people? Or was it both? Did the Dayuan people or the people who lived in Dayuan speak Tokharian, or were they related to the Tokharian-speaking Yuezhi? Or were they an altogether non-Tokharian but Saka or Iranian speaking Indo-European people?[18]

That the peoples Dayuan and Yuezhi were evidently on good terms and in communication with one another cannot be denied[19]. It was in Dayuan that Zhang Qian secured the guides and interpreters to take him through the. territory of Kangju and Yuezhi. The Yuezhi succeeded in their westward movement probably because of a congenial ethno-linguistic as well as cultural environment so long as the parties concerned keep their distance from the Xiongnu belt of depredations and pressure.

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[14] There is a continuing discussion on the relationship between the Shiji 123 and Qian Hanshu 61 regarding Zhang Qian's biography, as to which is the primary version, cf Hulsewe and Loewe (1979. 15 ff), and Hulsewe (1975· 83 ff); for *contra* see Daffina (1982 309 ff) and Enoki (1983. I ff) For earlier views see Haloun 1937 and Pulleyblank (1966 9-39, 1970. 154-60). I support the views of Pulleyblank, Daffina and Enoki.

[15] Hulsewe and Loewe (1979. 207) translate the relevant version of *Qian Hanshu* as "Ganfu, a slave of the Dangi family" and they remark in their in 765 "there has been a considerable speculation about the origin of the man called Ganfu, "Father Gan", However, due to the fact that Ḍangi was a nobility in those days (established early in 200 B.C. and only abolished in 116 B C)" this translation is warranted On the other hand it stands to practical reason that Zhang Qian should have a Xiongnu slave for his companion.

[16] "This refers to the so-called Yue, who continued to exist as independent communities in present-day south China andd northern Vietnam until the 'Chinese conquest and the establishment of Chinese administration in their territories beginning in 112 B C." See Hulsewe and Loewe (1979· 208).

[17] Watson (1961. 268), translates· The Yuezhi moved far away to the west, beyond Dayuan (underline mine) but Zürcher (1968· 360) translates "They passed through Dayuan (underline mine) I have preferred Watson's translation

[18] Pulleyblank (1966· 22) believes that the Dayuan were a Tokharian-speaking people. But there are other suggestions to the contrary

It is significant that Zhang Qian described the peoples of Anxi and Daxia as having the same lifestyle and customs as those of Dayuan. He did not say this in the case of the Da Yuezhi. He described the Kangju as resembling the Yuezhi, and the people of Yancai (**ap**) as having customs similar to those of Kangju.

It is noteworthy that Sima Qian (*Qian Hanshu* 96A, 36B, Hulswe and Loewe 1979: 132) remarks at the end of Zhang Qian's report: "Thus the emperor learned of Dayuan, Daxia, Anxi, and the others, all great states rich in unusual products, whose people cultivated the land and made their living in much the same way as the Chinese." All these states, he was told, were militarily weak and prized Han goods and wealth. He also learned that to the north of them lived the Yuezhi and Kangju people who were strong in arms but who could be persuaded by gifts and the prospect of gain to acknowledge allegiance to the Han court. We may also note Sima Qian's statement that the states from Dayuan west to Anxi spoke rather different languages, but that their customs were generally similar and their languages mutually intelligible, and that their men had deep-set eyes and profuse beards and whiskers.

But, in a much smaller section of Dayuan, *Qian Hanshu* states that, "... the soil, the climate, the productions, and the customs of the people are the same as those of the Da Yuezhi and Anxi ..." (*Qian Hanshu* 96A.31a; Hulsewe and Loewe 1979: 120). In the Da Yuezhi section it is noted that, "... the soil, the climate, the productions, the customs of the people, and the currency, are all the same as those of Anxi ..." (*Qian Hanshu* 96A, 36B, Hulsewe and Loewe 1979).

Thus, while a distinction is made in *Shiji* between Dayuan, Anxi and Daxia on the one hand and Da Tuezhi, Kangju and Yancai on the other, *Qian Hanshu* groups the Da Yuezhi, Dayuan and Anxi together. But this apparent discrepancy in the two accounts is easily resolved when we note a difference of more than one hundred years in their composition. During this period things did change in the Oxus valley not only politically but also culturally. Daxia had already been conquered by the Da Yuezhi and the latter had moved south of the Oxus. The power and territory of the Yuezhi were much enlarged. Culturally and socially the Yuezhi had come closer to the people around them by marriage and by adapting local customs.

Whether or not the Chinese character for Dayuan yields the word *Taxwar remains a theoretical problem. But the fact cannot be denied that the state of Dayuan, through which the Da Yuezhi might or might not, have passed on their way to the north of the Oxus, was not hostile to the Yuezhi. Linguistically the people of Dayuan were not as far apart from the Yuezhi as were the Chinese and the Xiongnu. That they were not like the Yuezhi for that matter is made clear by Sima Qian. Therefore it seems more reasonable to take Dayuan as a territorial name rather than as an ethnic one. Much before Zhang Qian's visit, Dayuan had ceased to be a mere tribal name and had acquired a territorial definition, with its peaceful people used to sedentary agricultural living.

Shiji states that "Dayuan is bordered on the north by Kangju, on the west by the kingdom of the Da Yaezhi, on the southwest by Daxia, on the northeast by the land of Wusun (**aq**), and on the east by Yumi (**ar**) and Yutian (**as**)" (*Shiji* 123, Watson 1961: 266). It also reports that Dayuan was "some ten thousand *li* directly west of China," that Wusun was "some two thousand *li* northeast of Dayuan," that Kangju was "some two thousand *li* northwest of Dayuan" (*Qian Hanshu* 96A.36B, Hulsewe and Loewe 1979: 132), that the Da Yuezhi was "some two or three thousand *li* west of Dayuan, north of the Guei River," and that Daxia was "over two thousand *li* southwest of Dayuan, south of the Quei River" (Pulleyblank 1966: 22-26). The *Qian Hanshu* on the other hand, reports that Dayuan adjoins Kangju in the north and the Da Yuezhi in the south, and that to the city of Betian (**at**) in Kangju in the north it is 1510 *li* to the Da Yuezhi in the southwest it is 690 (*Qian Hanshu* 96a, Hulsewe and Loewe 1979: 132).

Pulleyblank (1966: 22-28) found no way of recording these conflicting statements without assuming either that one or the other is wrong or that the situation had changed after the time of Zhang Qian's journey. He thought that the latter alternative was hardly conceivable as long as Dayuan was considered to be a place name, but it was quite possible to accept if, like Yuezhi, it was the name of a nomadic people. But he did realize that the main difficulty with this hypothesis was that there was no hint whatever in Chinese sources of a change in the location of Dayuan after Zhang Qian's visit. It is prima facie very strange that there should be no mention of such a major alteration. We must remember, however, that in those first few years of their penetration into the Western Regions the Chinese were moving in a completely uncharted area. Zhang Qian himself never revisited Dayuan and the Chinese who did go there may not have realized what a radical change had taken place. Or, at any rate, Sima Qian, sitting in his study back in China, may have had no clear idea of the situation. Pulleyblank would like his hypothetical people of Dayuan to have moved from somewhere in the region of Kucha to Sogdiana, and to him it seemed clear that Sima Qian had interpolated a later description of Dayuan into what purports to be Zhang Qian's report.

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[19] Nowhere in the relevant Chinese sources is there evidence of conflict between the two, Since The Yuezhi did not pass through the territory of Dayuan, but took a northerly route from the Upper 9 *li*, the question did not arise They were essentially sedentary and peace-loving, and avoided fighting. They did not obstruct Zhang Qian's passage to the Da Yuezhi but proved helpful quite unlike the Xiongnu

But these difficulties are Pulleyblank's own unnecessary creation. If we do not consider Dayuan as only a Tokharian speaking people but as also a territorial name, the apparent inconsistencies in *Shiji* and *Qian Hanshu* are easily resolved. It is not the Dayuan which changed position after the time of Zhang Qian's journey, but it is the Yuezhi, and possibly the Kangju also, which did. Their territorial definition remained so flexible over the whole period with which we are concerned that we have varying accounts, concerning their situation in relation to Dayuan. We are unnecessarily confusing the location of Dayuan. Whereas Dayuan's territorial identity remained fixed, both the Da Yuezhi and the Kangju were still mobile and politically and territorially changing positions. The Da Yuezhi crossed the Amudarya and occupied areas south of it so much so that Daxia ceased to be mentioned independently in *Qian Hanshu* And so also Kangju were, right from the beginning, sandwiched between their ethnocultural loyality and political friendship to the Yuezhi on the one hand and the military fear and political necessity of the Wusun, backed by the Xiongnu, on the other. Naturally, if the situation of the Kangju shifted from 'northwest' to 'north' and that of the Yuezhi from 'west' to 'southwest' and 'south' in relation to the politically stable and territorially fixed situation of Dayuan there is nothing surprising.

The last contacts between China and Dayuan under that name were in the time of the Western Qin in the 3rd century A.D. (*Jinshu* 97.1337.1). In the 5th century A.D. the ambassadors came from the country of Poluona (**au**) and presented "blood sweating horses" (*Weishu* 5, 1915). The *Beishi* (**av**) identifies Poluona with Dayuan (*Beishi* 97.3042.4). Most scholars identify it with Ferghana.[20] Probably Dayuan was what may be called a greater Ferghana perhaps extending up the river valleys to the Pamir watershed.[21] This extension would make sense of the eastern boundary description in relation to Yumi and Yutian as given in *Shiji*. If the historians of later Chinese dynasties mention several locations of Dayuan and did not know exactly where it had been, we need not blame them, for much happened later to change the geopolity of the area. On the other hand, it is noteworthy that the Chinese recorded the changing location of Dayuan as late as the fifth century A.D.

With Dayuan's position fixed, a definite point in the itinerary of the Da Yuezhi movement is obtained. It is evident that the Da Yuezhi did not subdue Dayuan: nor do we have evidence of their stay there. They moved on, either skirting Dayuan in the north, or perhaps they had unobstructed passage if they really passed through their territory. We do not know if either party had to pay a price for it. But, as we know, not much ground remained to be covered by the Da Yuezhi once they had arrived in the vicinity of Dayuan for as Zhang Qian reports, they lived close to Dayuan. The latter might even have helped them to occupy territories in their vicinity in their own interests (*Shiji* 123, Watson 1961: 266).

But why was Zhang Qian on his mission to the Da Yuezhi sent to Kangju by the king of Dayuan? It was the Kangju who provided Zhang Qian guides and interpreters. Obviously there was no direct route from Dayuan to the kingdom of the Da Yuezhi. The route westward from Dayuan was probably such that it overlapped with the territory of the Kangju and that of the Da Yuezhi. Which lay in a north-south relationship. This also reconciles the evidence of *Shiji* and *Qian Hanshu* in respect of their geographical position in relation to Dayuan, which means that the Kangju were northwest and the Da Yuezhi were southwest of Dayuan. The dividing line between the Kangju and the Da Yuezhi was probably provided by the Syrdarya in its middle bend with its centre point near Leninabad. The state of the Kangju was smaller than that of the Da Yuezhi. Probably it included the area north of the Syrdarya and west of the Kuraminskiye Satkalaskye mountain ranges, the lands watered by the rivers Angrem, Circik and Keles, all tributaries of the Syrdarya between Tashkent and Angren. In short, the Kangju state comprised the western part of the northeastern wedge of modern Uzbekistan into Kirghiziya and Kazakastan; the eastern part of this wedge formed part of Dayuan. The Da Yuezhi, who had settled south of the Syrdarya, after having subdued the Daxia and having confined them south of the Amudarya, had their kingdom roughly in the area watered in the north by the river Zeravshan and in the south by the rivers Surkhandarya, Kafirnigan, Vaksh and Kyzylsu-all tributaries of Amudarya. It compromised, in short, the entire mid-region between the Jaxartes and the Oxus, extending from Samarkand in the west to Dushanbe in the east.[22] The court of the Yuezhi ruler was set up on the northern bank of the Quei river. If this is the Amudarya, as is generally believed, the capital of the Da Yuezhi, before they annexed the Daxia territory south of the Quei, may be identified with one or other of the major archaeological sites on the northern bank of the Amudarya, in or near that of Termez (Hulsewe and Loewe 1979: 119-20).

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[20] Pulleyblank (1966: 22) notes that the identification of Dayuan with Ferghana is based on slender grounds On p 25 he remarks about the inconsistency of *Shiji* and first notes that "it seems to imply a location for Dayuan somewhere in the region of Kucha" and then later states that "the description of Dayuan in the *Shiji* as a populous land of many cities is much more consistent with Sogdiana proper than with Ferghana". But Kucha is already listed as an independent entity in the "Western Regions". And, Sogdiana had ceased to be an independent state after the rise of the Bactrian Greeks and had become part of the Bactrian state. On p 24 Pulleyblank suggests that when the Da Yuezhi went south of the Oxus their place in Sogdiana was taken by Dayuan = Tokhari But there is no evidence to suggest that the Da Yuezhi vacated their possessions north of the Oxus when they moved south of the river The whole arduous exercise Pulleyblank goes through is because of his initial proposal of Dayuan = *Taxwer and separating the Yuezhi's equation with Tokhari It is possible that after Heliokles, or before him, northeastern parts of Sogdiana became independent of the Bactrian Greek control and it was a contracted portion of the old Achaemenid Sogdiana that probably became part of the territory of the Kangju. For identification of Dayuan with Ferghana see, Herzfeld (1932. 22 ff) who thought that Dayuan was in the Pamirs

[21] See also Tarn (1951· 476-79) It partially covers Herzfeld's view too

The geography of the first phase of the Yuezhi movement covers a large space but yields much less information. Sima Qian provides only one vague piece of information for this entire phase, i.e. that when Zhang Qian was captured at the very outset of his journey by the Xiongnu he was informed that the Yuezhi lived north of the Xionghu, which means that they had left their home south of Xiongnu. Perhaps what was meant was the northwest, and that they had not yet moved far away from the Xiongnu. But the territory of the Xiongnu itself is undefinable. They had not yet become a territorial state and this information is hardly of any value geographically except to indicate that the Da Yuezhi had moved away from the Dunhuang region and were moving in a northwest direction. But there is not much of choice in the area for any other course of movement. The Yuezhi must have followed the well known route in the north via the Yumen gate and from Turfan, instead of going south to Qarashar and Kucha, they followed the northerly road. This means they avoided the regions south of the Tianshan which would in fact explain why they came in conflict with the Wusun, if the latter lived in Barkol, and why the first destination was the upper Ili, north of Tianshan.

The chronology of the great movement of the Da Yuezhi is quite evident. It was only after the Xiongnu Shanyu Jizhu had killed the king of the Yuezhi and made his skull into a drinking cup (or rice bowl) in 162 B.C. that the Da Yuezhi moved out from their original habitat. The exact date is not given, but surely it must have been before Jizhu died in 158 B.C. Probably the movement started around 160 B.C. (Narain 1957: 133).

How long did the movement take and when did it end? As we have noted earlier, Zhang Qian was a Palace Gentlemen (or Palace Attendant) during the Jianyuan (**aw**) era. i.e. 140-135 B.C. According to the *Shiji* he remained abroad for thirteen years and was awarded a title upon his return in 123 B.C. Obviously therefore he started on his mission in about 136 B.C. He had been detained by the Xiongnu for 'over ten years' before he escaped to resume his journey toward the Da Yuezhi. So he could not have reached them before 125 B.C. by which time the Da Yuezhi were settled north of the Oxus. Thus the Da Yuezhi movement which began around 160 B.C. must have ended already by 125 B.C.[23]

But certainly the Da Yuezhi did not move very far away at first. If the Xiao Yuezhi could survive by just moving a small distance southward among the Qiang and still another fraction of the people could continue to live in the Ordos region to be noticed as late as in the 5th century A.D.,[24] there is no reason to think of the Da Yuezhi fleeing to the far west all at once. As noted earlier two stages of their movement have been distinguished: the first, which took the Yuezhi from Dunhuang to the upper Ili, and the second, which took them from the upper Ili to the north of the Oxus. It took only twenty to thirty days for Zhang Qian to reach Dayuan once he escaped from the Xiongnu detention (*Weishu* 2.1907.3, Pulleyblank 1966: 18). The Da Yuezhi had gone beyond Dayuan on their way to Daxia but there is no distinct evidence that they passed through Dayuan. But they could have reached the Upper Ili north of Tianshan not long after 160 B.C. by the northerly route from Turfan, but they must have left the area about, or soon after 136 B.C., when Zhang Qian was captured by the Xiongnu and where he had learnt about Kunmo of the Wusun, because they were already settled north of the Oxus before 125 B.C. The first stage of the Da Yuezhi must have thus been over by c.135 B.C.[25]

Now for the balance of the story we must turn to other sources. According to Justin, Mithridates I (171-138) of Parthia and Eucratides I (171-155) of Bactria were great contemporary kings (Narain 1957: 53). But while Parthia was flourishing Bactria was being harassed in various wars with the Sogdians, the Drangians, the Indians, and possibly others. The Graeco-Bactrians were also fighting among

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22. Generally Kangju has been identified with Sogdiana But as a political territory Sogdiana had already ceased to exist after the rise of the Bactrian Greeks, and when the Da Yuezhi subjugated the Daxia they first occupied the region north of the Oxus, i.e what used to be a part of the old Sogdiana and 'as the' *Shiji* reports it, acknowledged nominal sovereigntly to the Yuezhi in the south and the Xiongnu in the east.

23 There is some discussion about the dates of the two stages of the Yuezhi movement. See Narain (1957: 133)

24 This date fits in very well with events in the history of Parthia, particularly the first mention of Tokhari in Justin in connection with the death of Artabanus II in 124 B C and the preceding encounters of Parthians with the "other non-Sai=Saka" Scythians, who had been forced out of Bactriana in the process of Yuezhi occupation of the region

25. The reason why Zhang Qian did not take the same route as followed by the Da Yuezhi and go to the upper Ili first, and not to Dayuan, was probably because he did not want to be caught again, this time by the Wusun, who were then under the Xiongnu hegemony He visited them later when the regional polity started showing signs of change

themselves (Justin xli 6. cf. Narain, 1980: 53, Debevoise 1938: 19). During the decade 160 to 150 B.C. Bacrtia lost two of its satrapies, Tapuria and Traxiana to Parthia (Narain 1957: 101 ff). There was erosion of Bactrian power in Sogdiana and Margiana. Rival Indo-Greek families were carving out their small kingdoms in the Kabul and Indus valleys (Strabo, xi.11.2; Narain 1957, Tarn 1930: 20-24; Colledge 1967: 28-29). By the time Heliokles I died in 140 B.C. (Narain 1957: 106).[26] Bactrian authority had virtually ceased to extend beyond the Oxus in the north. Mithridates died in 138 B.C (Colledge 1967: 30), and on his death fortune turned her back on the Parthians also. By a significant coincidence this was about the time when the Yuezhi were being forced to leave their recently acquired abode in the Upper Ili basin and with the Wusun and Xiongnu behind them they had no alternative but to press forward in a westerly direction. They had already dispersed the Sai, i.e. the Sakas of the Ili basin **southwards**. Now it was the turn of the "other" Scythians, i.e. the non-Sai-Saka, those who were the "Cis-Imaus" ones of Ptolemy and/or the Sacaraucae of Strabo, to get destabilized (Narain 1957: 134). No wonder Strabo listed both the Saka-Scythian and Tokharian tribes among the "best known nomads who took away Bactriana, who originally came from the country on the other side of the Jaxartes" (Strabo XI.8.2). The power vaccum in the productive lands between the Jaxartes and the Oxus naturally attracted a strange medley of nomads and semi-nomads, all desperately looking for new homes. The sedantaries of Dayuan and the traders of Sogdiana had bought peace by allowing passage to the Da Yuezhi. The "Scythians, the non-Saka ones, of the north of Jaxartes who were not allowed time by the pursuing Da Yuezhi to establish a solid footing in the region, had no option but to continue pressing forward in a westerly, or in southwesterly direction, rather than descending directly to the south to occupy Bactria proper, the Daxia of the Chinese sources. This they did at the cost of the Parthians. Phraates II (138-128) of Partia had called in the aid of the Scythians in his war against Suria, but when he refused to pay them they killed him. When Artabanus II succeeded to the throne in 128 B.C., some of them took the western route and overran the provinces of Parthia and Hycrania. Finally in the period of Mithridates II some turned southeast ultimately finding themselves in the settlement of Sacastene (Narain 1957: 134; Colledge 1967: 32). When Zhang Qian visited the Yuezhi in 125 B.C., the non-Saka-Scythian nomads had already left the northern regions of Bactriana. This is why when Justin refers to the encounter of Artabanus II with nomads, fighting against whom he was killed in 124 B.C., he refers to them as Tokhari: and, Justin need not be making a mistake (Justin XI.II.2.1.2). Surely, the Tokhari were not willing to let Artabanus emulate Mithridates I. Tired of moving from one place to another, they would not be prepared to be displaced again, especially from the fertile valley which they had come to occupy. When Zhang Qian was visiting the Da Yuezhi they were just emerging out of a dangerous decade of instability and they surely needed security and peace. This is why they refused to oblige the Chinese even against their old enemy, the Xiongnu.

Having got rid of the turbulent non-Saka-Scythians of the Syr-Amu region and having throughly thwarted the Parthians, the Da Yuezhi addressed themselves to the task of restoring confidence in the body politic of their new area, for certainly they meant to stay there. Mithridates II, the new king of Parthia, who succeeded Artabanus in 124 B.C , also became busy in bringing stability back to Parthia. He recovered lost provinces, bought peace with the restive Scythians by letting them settle down in Sacastene perhaps as a vassal state, and took care not to involve himself in the affairs of the east. This gave the Da Yuezhi the much-needed respite, and a free hand for the reorganization of the economy and polity in the Bactrian region.

We must, however, now discuss the identity of the ruler of the Da Yuezhi. So far no serious attempt has been made to identify the person who led the Da Yuezhi to Daxia and established them there. It is strange that even Zhang Qian omitted to mention the name, or any other detail of the ruler he visited, even such as whether the ruler was a man or woman. Based on the commonly accepted translation of the relevant texts[27] it has been generally believed that the Yuezhi odyssey was led by the son of the king who was killed by the Xiongnu. But it may be noted that *Shiji* has a variant reading meaning "his consort" instead of "his crown-prince," (Zürcher 1968: 359, fn.3). The *Qian Hanshu* text which states that they had set up his (principal) consort as their "king" also has a variant reading meaning, "the crown prince (born from) his (principal) consort (**ax**)" (Zurcher 1968: 359, fn.3). The latest translation (Hulsewe and Loewe 1979. 208) of this passage reads, "the king of the Da Yuezhi had been killed by the nomads, and his wife had been established as king (*sic*); having subjugated Daxia she reigned over it. The Sung commentator Sungji in an early edition of the *Hanshu* remarks that he had seen an ancient copy of the *Hanshu* which read, "his wife (and) heir apparent" for *furen* (**az**) 'wife', but on the other hand one of the older commentators of *Shiji* reads *furen* 'wife', like the *Hanshu* (Hulsewe and Loewe 1979: 208, fn.770 and Loewe 1963:

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[26] Some of the Indo-Greek kings after Heliokles I are known to have issued Attic tetradrachms but, to the best of my knowledge, they have never been found north of the Oxus, and the last coins to be imitated by the newcomers north of the Oxus were still those of Heliokles I

[27] *Shiji* 123 2a and *Qian Hanshu* 61 2a.Cf translation by Zurcher (1968. 359) "The King of the Da Yuezhi has been killed by the Hu (= Xiongnu), and they (the Yuezhi) had set up their crown-prince as their king "

165ff). It is interesting to note that even when the texts read 'consort' or 'wife' she has been referred to as 'king' and not as 'queen'. As has been noted by Hulsewe and Loewe (1979: 208) all texts have *wang* 'king', normally referring to a man, but exceptionally also to a woman, as in the case of Japan (*San guo Zhi Weiji* 30, 34b — Tong wen edition). Of course, it can be argued that the use of wang 'king', strengthens the argument for reading *daizi* "heir-apparent", instead of furen "wife", but Hulsewe and Loewe have retained the *lectio difficilio* (Hulsewe and Loewe 1979: 208 fn.770).

It is obvious that there is some misinformation involved in the Chinese reports. One plausible way to reconcile the textual problem is to assume that the Da Yuezhi king who was killed by the Xiongnu was survived by his principal consort who was probably pregnant at the time. When a son was born he was designated the 'crown-prince' and the wife of the late king acted like a queen-regent and she ruled vicariously until the 'crown-prince' grew up to be of an age to rule on his own. It is not clear whether Sungji's version "... (his) wife (and) heir-apparent..." denoted two persons, i.e. the queen and the prince, or only one person, i.e., the queen, who became the heir-apparent on account of the special circumstances The latter hardly seems to have been according to the custom, and the former will only mean that the son was already born but was a minor, perhaps just a baby. But whether the crown-prince was already born when the king was killed, or was born later, the regency of the Yuezhi queen-mother need not be doubted. This hypothesis adds new significance to the Yuezhi history. For this brings to light not only the role and importance of women among the Yuezhi but also the successful career of a nameless queen who accepted the challenge of leading her people in a most difficult situation of their history. I wish the Chinese had recorded the name of this courageous woman.

The crown-prince must have been old enough to become the king of the Da Yuezhi by c. 135 B.C. when they left the Upper Ili regions to subjugate Daxia. He was probably about twenty five years old then and must have been the king of the Da Yuezhi when Zhang Qian visited them. For if the Da Yuezhi were ruled by a woman then Zhang Qian could not have omitted to mention this speciality of the Yuezhi. Having failed in his mission to win the friendship of the young king, was Zhang Quin so frustrated that he did not care to mention even the name of this king. Who was this nameless king? So far no attempt has been made to identify this energetic founder of the new Da Yuezhi kingdom in the Oxus valley.

But there is one 'nameless' king in the repertory of relevant coinage whose identity has so far defied any agreement. While a fuller discussion of his coinage is discussed elsewhere (unpublished paper), here it may suffice to announce that in my view the Da Yuezhi king, who subdued Daxia, is none other than the X 'nameless' king, who is well known to students of numismatics as "Soter Megas", whose coins, without bearing his personal name but only with the inscription, Basileus Basileun Soter Megas i.e. "king of kings, the great protector", circulated widely.

Before the Da Yuezhi entered the trans-Oxus regions of Bactriana and Sogdiana there was a flourishing monetary economy which had already enjoyed a coinage system for more than a hundred years. However, the displacement of peoples, the prevalence of violence and insecure polity had disturbed the social and economic equilibrium. The demand for economic well-being was obvious and the climate had once again become favourable to it. But the Yuezhi came from a background which was not familiar with a monetary economy having been used to one based on commodity circulation Cut off from their original environment, it was neither easy for them to adopt a natural economy in their new land, nor was it advisable for them to do so in a region where external elements had already shown the advantages of a money economy. It was easier and more profitable for them to revive the monetary economy in spite of the handicap of not being familiar with the system of coinage, because the mints were there and they could use them and experiment At first it appears that they could not obtain the services of able mint masters, who must have died or fled in the period of turmoil. It was also not wise to make drastic changes and introduce new types. Demand and design perhaps prompted a graduated return to a monetary system and typology which would find acceptance in the region. For a period of time, therefore, the Da Yuezhi allowed the minting of the barbarous imitations of the Graeco-Bactrian coins, those of Euthydemus I, but more usually those of Eucratides I and Heliocles I. Some of these imitation coins were already being struck by the Saka-Scythians from beyond the Jaxartes briefly though before the Yuezhi entered Sogdiana and Bactria.[28]

However, once the Da Yuezhi king understood the system and found his position stable enough he was ready to introduce a change, and project his own image on the coinage. Along with the coins in imitation of Euktatides and Heliokles which were perhaps being minted by private enterpise with his permission, now he issued coins with his own bust with devices borrowed from the preceding Graeco-Bactrian coin-types of Eukratides and Heliokles, with which people in the region were already familiar, i.e. 'the king on horse' and 'the standing Zeus'. Most of the features, the border, the headdress, the diadem, the script, the style and content of the legend, arrangement, and metrology, belong in the Graeco-Bactrian tradition

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[28] For a description and discussion of these coins, see Cunningham (1889 268-311), Mitchiner (1973. 30 ff, 1975-76 283, 301), Macdowall (1968. 28-48)

(Cunningham 1890: 114-17, Pl.IX, Mitchiner 1973: 55-65, Pl. XII-XIV, 1976: 302, Masson 1950: 1-47, Whitehead 1914: 100, 161-162). But the face of the king is not-so-Greek and there is a *tamga*, perhaps the Yuezhi symbol which is consistently shown. While a few silver coins of this new type were minted along with the 'imitation' coins, the bulk (of the money) was in copper and bullion. It seems silver had to go out of vogue partly because of gradually decreasing supply of the metal and partly because of the restricted exchange demands for silver on account of troubled times and unfavourable contemporary inter-state trade relations (Masson, 1950: 40 ff; Tarn 1951). The copper coins of the 'nameless' king which supported the day-to-day economy of the people became so popular and their demand so increased that they continued to be minted even after the death of this great king and were circulated not only in the nuclear Yuezhi state to start with but gradually also throughout the entire Yuezhi-Kushana domain as it expanded, until superceded finally by the later plentifully struck copper coins of Kanishka. This was also perhaps the beginning of the process which virtually drove out silver, first from the Yuezhi-Kushana money market, and in due course, even from many areas of the South Asian market for several centuries.

The 'nameless' king is generally shown as a young handsome man on most of his coins though there are specimens where he is shown growing in age (Cunningham 1889: Pl.IX.4 and 6; Mitchiner 1973: Pl.XII.100.101 and XII.105, XIII.134a, XIV, 147). It is possible that his handsome bust with radiate headdress became idealised in time and coins were minted with that bust not only by him but also by his Yabgu chiefs during his lifetime, as well as by some of his successors after his region. The mystery of not giving the name of the king on the coin may perhaps lie in the grandiloquent titles themselves and in the Yuezhi tribal polity where the king was not just a person but a symbol of tribal solidarity, status and prestige, of divine quality in which the roots of the later ruler cult of the Kushanas may also be discovered. He was the king of kings (Basileus Basileon), he was the Protector (Soter), and he was indeed the Great (Megas). In rejecting the overtures of the Son of Heaven from China he was no less affirming his own exalted position. His role and achievements more than justified his titularies. The Yuezhi had nourished him from his childhood. The child had grown to manhood. Everybody knew him and they all looked up to him. He had justified their expectations and fulfilled their aspirations in leading his people to form a new state by conquest. The use of Soter and Megas in the coin-legend in the nominative, and not in the genitive case, confirms that he was not using these epithets as attributes of the king but had appropriated them as personal names, for he was indeed himself 'Soter' and 'Megas' incarnate. If the radiate bust showed his transcendental status, his *tamga*, the symbol of his tribal identity. This was sufficient. Nothing more was needed. As we dicsuss elsewhere, this coinage was very much in keeping with the ideology and basic structure of the federal polity of the Yuezhi. It is only later, with the Kushana expansion southward and southeastward, that bilingual coins in his name were minted with the Kharoshti legend, and people wondered about the use of the epithets 'Soter' and 'Megas' in the nominative and therefore following the normal practice used them in the genitive case, and introduced his name in an abbreviated form *Vi* (Cunningham 1889; Mitchiner 1973 for discussion). I wish that we had his full name somewhere to substantiate this. Cunningham thought that it stood for Vikramaditya but gave no real evidence to support this except a chronological coincidence (Cunningham 1889: 115). But certainly it was not an abbreviation of Wima Kadphises because Wima issued coins with his full name.[29] The abbreviation *Vi* was also used on the small anepigraphic copper coins where it was necessary (Mitchiner 1973: 63, Pl.XIII.133). Be that as it may, and since we discuss the numismatic aspects in greater detail elsewhere, suffice it to say here that Soter Megas, the founder of the Yuezhi state in the West, had a long rule as is clear from the volume and circulation of his money, even assuming that some of these were issued by his successors. Having brought the politics and economics of trans-Oxiana under his control he was ready to lead his people across the Oxus and occupy Bactria proper in the later part of his regin.

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[29] For coins of Wima Kadphises see Gardner (1886 124-28, Pl. XXV)

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Glossary of Chinese Names and Words

	Pinyin System used in the article	Chinese Character	Wade-Giles System used earlier
a.	Guishuang	貴霜	Kuei-shuang
b.	Yabgu (Xi-hou)	歙侯	Hsi-hou
c.	Yuezhi	月氏	Yueh-chih
d.	Tu huoluo	吐火羅	T'u-huo-lo
e.	Xiongnu	匈奴	Hsiung-nu
f.	Da Yuezhi	大月氏	Ta Yueh-chih
g.	Qin	秦	Ch'in
h.	Shi Huangdi	始皇帝	Shih Huang-ti
i.	Touman	頭曼	T'ou-man
j.	Shanyu	單于	Shan-yu
k.	Meng Tian	蒙恬	Meng-t'ien
l.	Maodun	冒頓	Mao-tun
m.	Mingdi	鳥鏑	Ming-ti
n.	Donghu	東胡	Tung-hu
o.	Loufan	樓煩	Lou-fan
p.	Boyang	白羊	Po-yang
q.	Han Wendi	漢文帝	Han Wen-ti
r.	Jizhu	稽粥	Chi-chu
s.	Laoshang	老上	Lao-shang
t.	Chaona	朝那	Ch'ao-na

	Pinyin System used in the article	**Chinese Character**	**Wade-Giles System used earlier**
u.	Xiao	簫	hsiao
v.	Sun Ang	孫卬	Sun Ang
w.	Beidi	北地	Pei-ti
x.	Peng Yang	彭陽	P'eng-yang
y.	Huizhong	回中	Hui-chung
z.	Ganquan	甘泉	kan-ch'uan
aa.	Yong	雍	Yung
ab.	Changan	長安	Ch'ang-an
ac.	Quang	羌	Ch'iang
ad.	Xiao-Yuezhi	小月氏	Hziao Yueh-chih
ae.	Gui shui	媯水	Kuei-shui
af.	Zhang Qian	張騫	Chang Ch'ien
ag.	Junchen	軍臣	Chun-ch'en
ah.	Shang	上	Shang
ai.	Yunzhong	雲中	Yun-chung
aj.	Wu di	武帝	Wu-ti
ak.	Longxi	隴西	Lung-hsi
al.	Ganfu	甘父	Kan-fu
am.	Yue	越	Yueh
an.	Kangju	康居	K'ang-chu
ao.	Fengshijun	奉使君	Feng-shih-chun
ap.	Yancai	奄蔡	Yen-ts'ai
aq.	Wusun	烏孫	Wu-sun
ar.	Yumi	弭	Yu-mi
as.	Yutian	于闐	Yut'ien

	Pinyin System used in the article	**Chinese Character**	**Wade-Giles System used earlier**
at.	Beitian	卑闐	Bei-t'ien
au.	Poluona	破洛那	P'o-lo-na
av.	Beishi	北史	Pei-shih
aw.	Jianyuan	建元	Chien-yuan
ax.	Qifundataizi	其夫大太子	Ch'i-fu-ta-t'ai-tsu
ay.	Qirentaizi	其人 太子	Ch'i-ren-t'ai-tsu
az.	Furen	夫人	Fu-jen

The Interface of Archaeology and History*

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The Comparative Neglect of Historical Archaeology

While writing the *Archaeology of Early Historic South Asia* (Allchin *et al.* 1995) I became increasingly perplexed by the comparative neglect of the archaeology of the historical period in South Asia, and by the crude and often undeveloped methods used for its study, when compared with those current in either prehistory or protohistory. I touched briefly on this topic in the Introduction to that book, but lack of space prevented me from developing it in the way I wished. It was then that I made up my mind that when an opportunity arose I would deal with this theme at greater length. The occasion of the Sankalia lecture appears to be just such an opportunity.

May I, at the outset, express my gratitude to the organisers of this Conference for the honour they have done me in this respect, and the great pleasure I feel in being invited to give this lecture in honour of the memory of Professor Sankalia, a scholar who more than any other embodies the ethos of advancing archaeology in independent India; and who more than any other can claim the credit for making archaeology a respectable and accepted subject of study and research in Indian universities.

My plan will be first to discuss briefly Sankalia's contribution to the subject, and to note the extent to which his major research interests lay in prehistory and protohistory, rather than in historical archaeology. Next I shall look for guidance in another area where — for whatever reasons — the methodology of historical archaeology developed at a comparatively early date. For this I have chosen Britain in the late Roman and Dark Age periods, mainly because there appear to be interesting comparabilities between the two contexts, and because the examples I quote suggest approaches which might be usefully adopted in India. After these introductory remarks I shall come to the two main topics of this lecture. These are:

a) to offer some ideas on the choice and development of a strategy to promote progress in historical archaeology; and

b) in this context to consider the interrelationship of Early Historical archaeology with history and other disciplines.

Sankalia's Approach to Historical Archaeology

Sankalia'a many facetted interests embraced a very wide spectrum, and it is evident that at the outset his concept of 'archaeology' was broader than many archaeologists would wish to accept today. In some of his early papers he shows an interest in cultural geography and its relationship to such things as temples, inscriptions, political and ethnic divisions (Sankalia 1949). Viewed from the viewpoint of archaeology it appears that his treatment of these subjects in some respects lacked clarity, and to my mind at least — does not compare favourably with the single minded fervour he displayed in his contemporary writing on prehistory (Sankalia 1946). It is as though he assumed one persona in the former context and another in the latter. Nonetheless, his earlier work shows how boldly he used epigraphical materials to approach historical, cultural and ethnographic analysis. At the same time there is a noticeable lack of applications involving archaeology in its narrower technical sense.

In his later writings, once he had embarked on the series of major excavations with the collaboration of colleagues of the Deccan College, Pune, from the small beginnings at Nashik and Jorwe in the early fifties, through to Maheshwar-Navadatoli and Nevasa, and culminating in planning the excavations at Inamgaon, a new approach makes a still rather tentative appearance. For example, the mass of well stratified data from the excavations at Nevasa, opened the door to all sorts of interesting studies of the Early Historic period at that site. Here at last the potential of such excavations for numismatics, and for economic history and local and long distance trade, are evident. But, in spite of the careful listing of finds of amphorae and megara type wares, coins, etc., the significance of such finds for understanding the Roman trade is barely exploited in the Nevasa report (Sankalia *et al.* 1960). The value of reports of this calibre is not in question; and the Nevasa report has since been recognized as providing a basis for gaining a better understanding of Roman trade contacts with India (see for example S Gupta in press).

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* The seventh Professor H.D. Sankalia Memorial Lecture delivered at the XXV Annual Conference of the Indian Society for Pehistoric and Quaternary Studies, Srinagar, Garhwal, 16-18 October 1997

It would seem that as time went by Sankalia gradually became aware of the potential contribution archaeology could make to early historical studies. For example, in his earlier writing he had used coins simply as a numismatist or historian might, but in the preface to *Aspects of History and Archaeology* (1977: xii) he remarks that:

> "What will truly advance our knowledge of these and other dynasties will be the discovery of coins in stratified contexts. This, a numismatist alone cannot hope to accomplish".

Again in the same context Sankalia boldly advocated the study of town planning and settlement studies, and suggested that, under the influence of the 'New Archaeology', all sorts of topics could become the basis of study through 'strictly archaeological data'. For example, archaeology might supply evidence for such matters as the prevalence or otherwise of meat eating at various times during the past. Incidentally, here he echoed ideas which we had already expressed long before the appearance of the 'New Archaeology'! (Allchin 1969: 320). Here then we see the beginnings of a quite new approach to archaeology in a historical context. I should also add that at a different level the building up of the Deccan College as an all-India centre for archaeology; the bold policy of opening the College to international exchange and contact; the creation of posts for specialists in different branches of scientific archaeology; and Sankalia's own open minded examination of the 'new archaeology'; all contributed to the creation of a base from which all types of archaeological research, including historical, could be promoted.

An Early British Approach

In thinking how to approach the advancement of historical archaeology my thoughts turned to the remarkable flowering of Early Historic archaeology that occurred in north Britain in the last decades of the nineteenth and early years of the twentieth centuries. Among the scholars who contributed to this were W.G. Collingwood (1854-1932), an art historian and colleague of Ruskin, who developed an interest in archaeology and who made a special study of the late Roman and Dark Age monuments and sculptures of north Britain; another major figure was Professor F. Harverfield whose magnum opus was his study of the *Romanisation of Roman Britain* (1913, 4th edition 1923), in which he used archaeological and historical sources in order to try to understand the actual process of Romanisation as it had occurred in Britain; R.G Collingwood (1889-1943) (the son of W.G.), became Professor of Philosophy at Oxford, but followed his father as a draftsman and artist, as well as an archaeologist. It was he who recognized the special character of this North British 'school' and gave a coherent exposition of its theroetical basis. Among younger members of the school were Professor Ian Richmond (1902-1965); and a number of juniors, including Dr. F.T. Wainwright (1918-1961) whose early death, like that of our own friend Professor B. Subbarao, cut short a most promising career. Since I first encountered this group, some forty years ago I have been aware that their role in the development of British archaeology has been underrated (at least in the south of the country), and I have come to think that their philosophy has much to offer to the development of historical archaeology in India.

R.G. Collingwood's most lucid exposition of what he saw as the special features of this 'school' can be found in his *Autobiography* (1939), but the practical application of his ideas can be understood from two of his major contributions, *The Archaeology of Roman Britain* (1930) and *Roman Britain and the English Settlements* (1936). *The Idea of History* (1946) is a more philosophically oriented study which arises from his earlier work. Collingwood's observation was that the northern scholars we have just mentioned had consciously adopted a 'Baconian' postion towards archaeological research. The term 'Baconian' refers to the work and thought of the 17th century English polymath and philosopher Francis Bacon, one of whose main contributions was an attempt to analyse the nature of scientific knowledge and purify its methods of research. This involved an adaptation of the scientific principles of seeking answers to questions and of experimentation as basic research tools for archaeology. As Collingwood (1939: 122-24) saw it experience in the field showed that:

> "One condition, — indeed the most important condition — of success was that the person responsible for any piece of digging, however large or small, should know exactly why he is doing it. He must first of all decide what he wants to find out, and then decide what kind of digging will show it to him".

In support of this view he argues that:

> "Harverfield and his colleagues in the 1890s had been consciously and completely Baconian in their meth-

> ods. They never dug a trench without knowing exactly what information they were looking for; they knew both that this information was the next thing they needed for the progress of their study, and also that this trench would give it to them. That is why they could settle highly abstruse and intricate problems at a cost of never more than £ 30 a year".

By contrast he found that among archaeologists in the south of Britain there was little awareness of this approach, and that they tended to follow closely the methods of General Pitt-Rivers who, while he was a great master of excavation technique, with regard to the problems to be solved by excavation was for the most part (not quite consistently) in the pre-Baconian stage (p. 124). Collingwood cited the dictum of Lord Acton, 'Study problems not periods', and adapted it for archaeology as 'Study problems not sites'.

Collingwood thus formed the view that archaeology provided a wonderfully sensitive method for answering questions to which literary sources could give no direct answer (Collingwood 1939: 133-34). One can agree with his contention that this method shares in some respects in the basic methodology of scientific research. What perhaps has not been sufficiently appreciated is the way in which the work of these scholars of the North British group anticipated some aspects of the 'New Archaeology', particularly in the way that both looked towards scientific methods to guide their paths, and both adopted a problem-oriented approach. The neglect of principle calls to mind another of Collingwood's dicta, that no historical problem should be studied without study of what he called is *second order history*, that is the history of historical thinking about it.

By making this comparison between the North British school and the New Archaeologists, I do not mean to give the impression that the latter merely copied their predecessors, because the aims of the two groups were in other respects very different. Nor do I mean to suggest that we should neglect the ideas and methods of the New Archaeology. As I see it both groups embodied positive advances in archaeological interpretation, and form part of a single historical tendency. In passing, one may remark on a significant difference between the northern school and the New Archaeologists. The former for the most part employed simple and plain language in their writings; and did not worry overmuch about underlying matters of theory. By contrast, the New Archaeologists have often seemed more concerned with verbal formulations of theoretical correctness than with the empirical facts involved, and employed turgid prose, laced with newly concocted terms. The early stages of this tendency had already attracted Sir Mortimer Wheeler (1956: 223), who wrote in a characteristically colourful turn of phrase of a recently published work as 'gobbledygook, that wonderful American carpet-bag of wordy and woolly pomposity'! It seems that he was inspired to write this purple passage by the recent appearance of W.W. Taylor's *Study of Archaeology* (1948). What emerges from Collingwood's consideration of the northern school is a mode of problem-oriented research, and this I believe can be fruitfully employed in almost any research situation. Collingwood cited the economy and cost effectiveness of research and excavations done in this fashion and this leads me to quote a further example of this in practice in the North British school.

Ian Richmond developed an almost uncanny insight into Roman Britain, and could read from archaeological sites and remains much that was totally ignored by other observers. I remember how on one occasion he visited Verulamium where I was one of a small group of students working for Sir Mortimer Wheeler. Richmond looked at the site we were excavating and then twitted Wheeler for having cut through, without realising it, 'the most interesting part of the deposit' so as to reach more quickly the earlier (and to him less interesting) levels. He then proceeded, with a few deft strokes of the trowel to demonstrate that we had all ignored the superficial traces of evidence for the Late Roman-Anglo-Saxon occupation.

Richmond's approach to fieldwork was unusual. In the last year of his life he completed a long series of September seasons, working with only one colleague, at the Roman military fortress at Inchtuthil, where he recovered the entire plan of the complex buildings contained in such a complex, as well as enough evidence to date the structures and their subsequent history: all this was done with a minimal expenditure of either man-hours or money. This is an instance of the use of the principle advocated by Collingwood. It also illustrates his remarkable insight into the history of Roman military expansion into central Scotland (Fig. 1). His untimely death in his early sixties sadly left much of his voluminous fieldwork incompletely published, — a fact which Sir Mortimer Wheeler remarked on in an obituary.

The final member of this North British group was Frederick Wainwright. Although he was only five years my senior, unhappily I never met him and know him simply from his writings. It was particularly his little book on *Archaeology and Place-names and History* (1962) which won my heart. Here he probed the interaction of archaeology and history, language and place-name studies, and gave a number of illuminating examples of the role of each with reference to post-Roman Britain and Scotland. To quote briefly from his introductory remarks:

> "History, archaeology and the study of place-names each provide information that is badly preserved or not preserved at all in the other two. They are to a great extent complementary to each other, and whenever

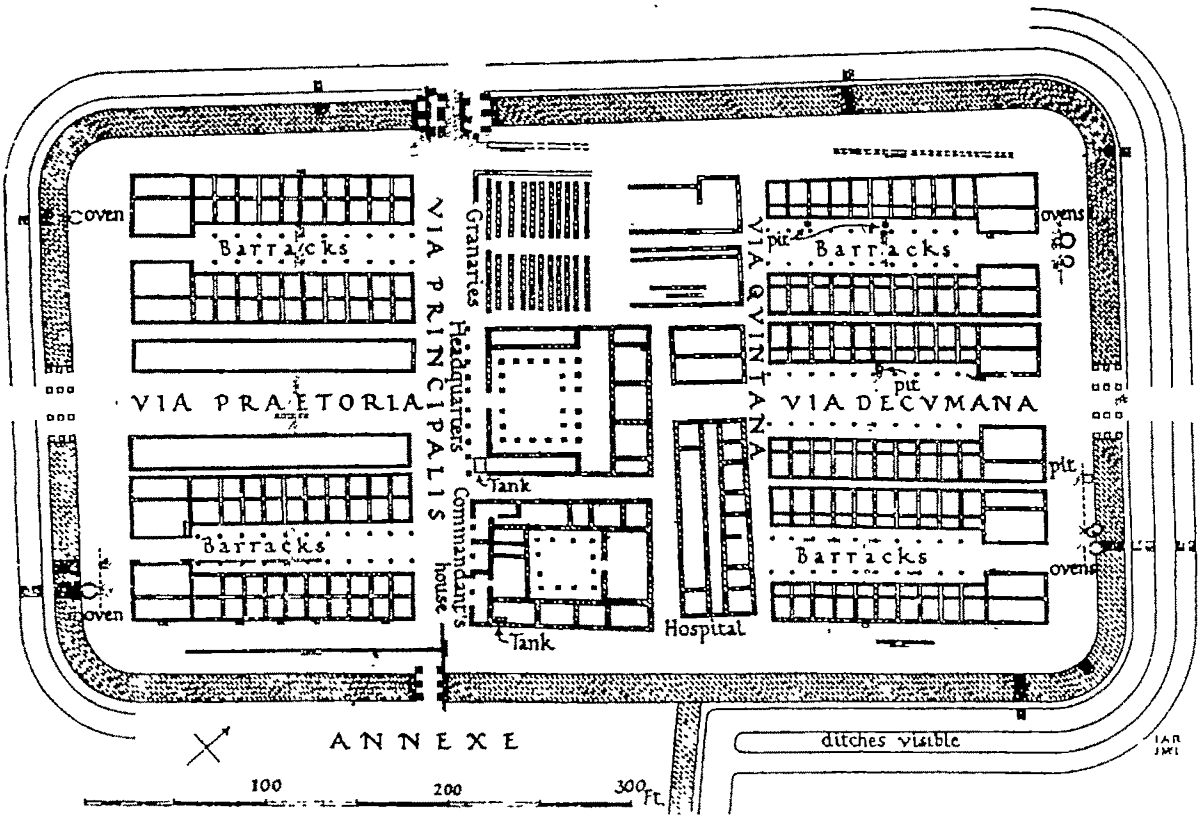

Fig. 1: Fendoch, Perthshire: a typical Roman frontier fort of the time of Agricola (80-100 A.D) (after Richmond 1955)

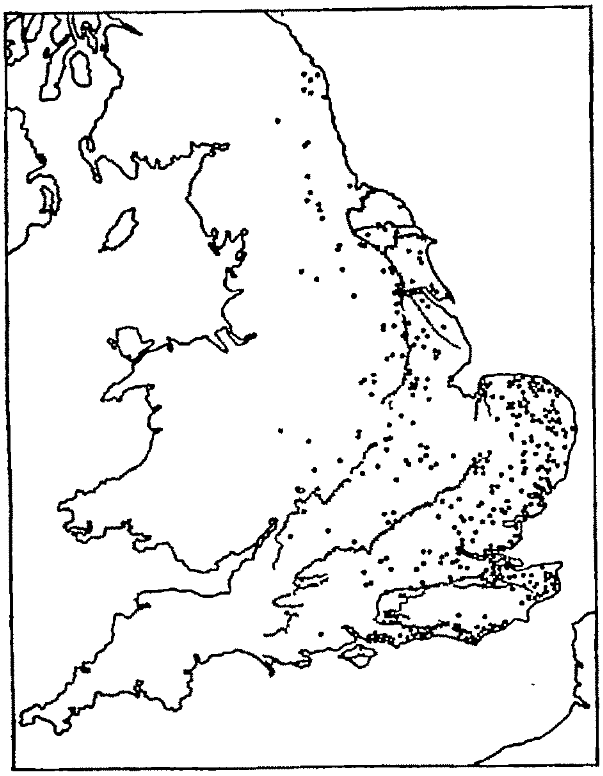

Fig. 2: Distribution of 'early' Anglo-Saxon place-name elements (*-ing* and *-ingham*) (after Wainwright 1962)

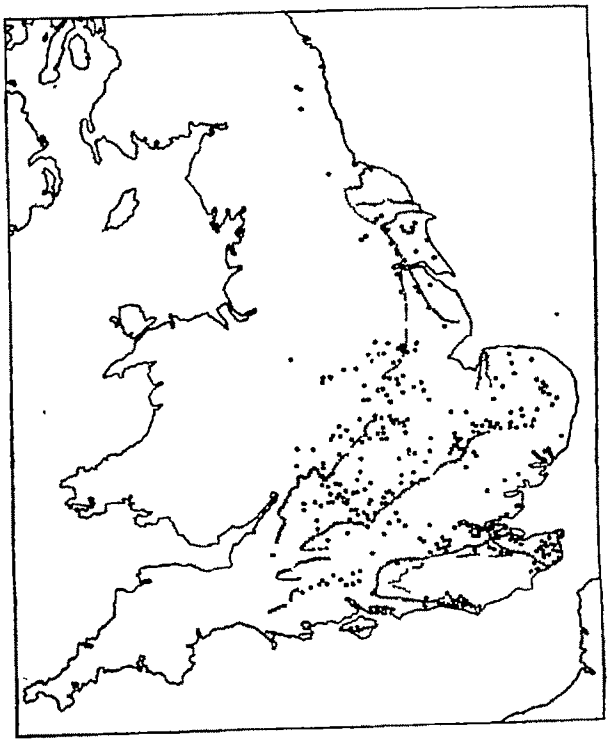

Fig. 3: Distribution of Anglo-Saxon burial places· • cemeteries; o single (after Wainwright 1962)

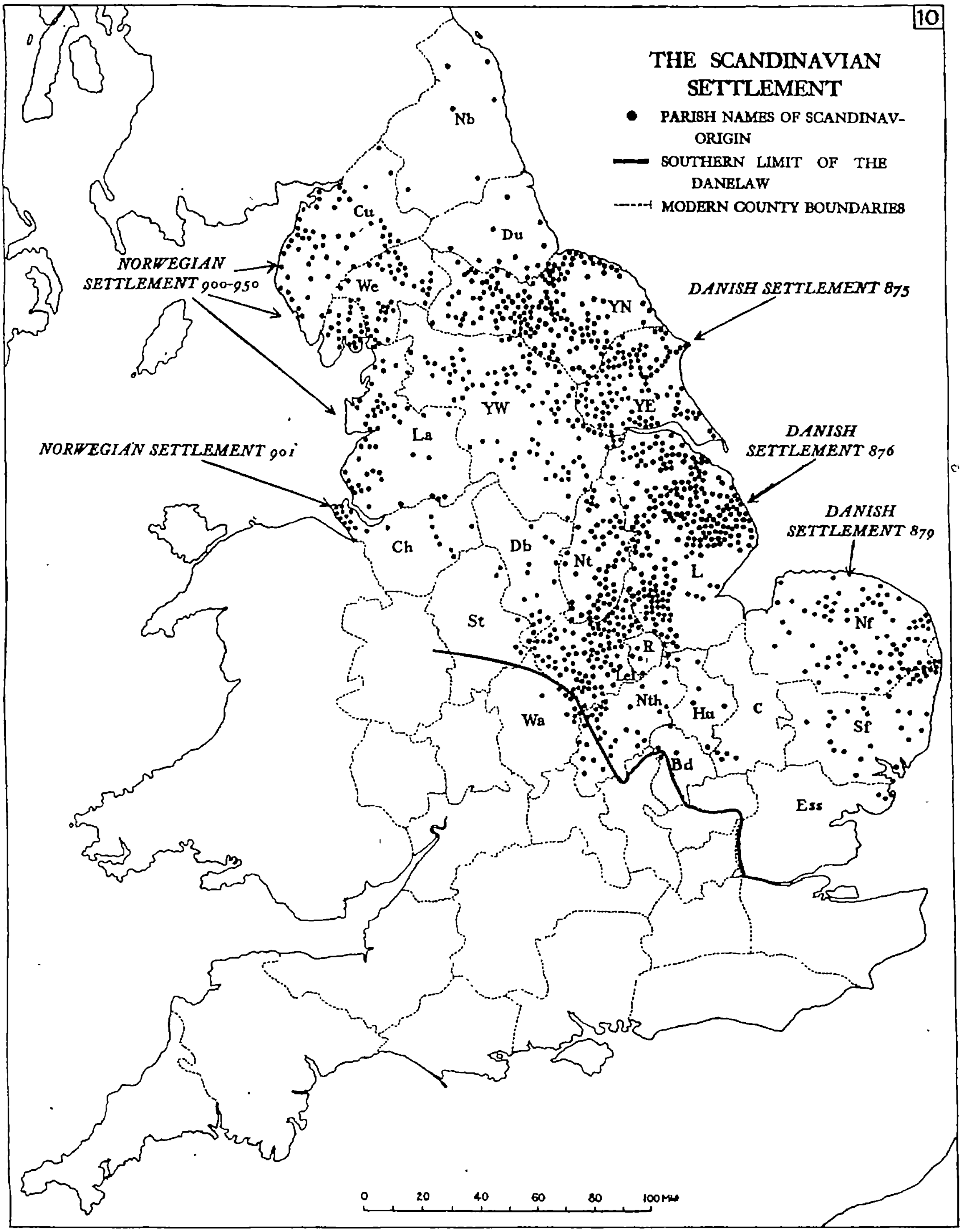

Fig. 4· The Scandinavian Settlement: place-names of Norwegian and Danish origin (after Smith 1956: map 10)

> two or more of them have been brought together in effective collaboration our understanding of the problems at issue has always been widened and deepended".

I may cite one or two examples of the kind of interaction between archaeology, place-name evidence and history which Wainwright discusses in his book. During the post-Roman period a series of separate, but related, ethnic groups crossed the North Sea and settled in different parts of Britain, previously inhabited by a number of Celtic speaking tribes. The main body of these settlers were Anglo-Saxons, and it has long been recognized that the early settlement phase may be seen in certain distinctive toponyms (or as we should say in common English place-names), or even place-name elements. The Anglo-Saxons, particularly in their pre-Christain stage, also had distinctive burial patterns, and a comparison of these two elements may be most enlightening (Fig. 2 and 3). In these centuries other groups of settlers came to different parts of Britain, including Danes and Vikings, and areas of their initial settlements can also be recognized in the place-names (Fig. 4). Place names can reveal evidence of other ethnic movements, even when these are not clearly differentiated in the archaeological record. Thus, the generally held view that the pre-Saxon inhabitants of Britain spoke dialects of Welsh or Britannic, and Gaelic and other Celtic languages, is supported by a map showing the distribution of river and place names deriving from those languages (Fig. 5); similarly a distribution of toponyms involving the element Pitt is seen to coincide with the area occupied by a distinctive Celtic group of the Picts who settled in eastern Scotland in pre-Roman times; and the extent of the settlements of the Celtic Iceni tribe, whose queen Boudicca (Boadicea) led an early revolt against the Romans, can be seen in the modern distribution of places with the element Ick in their toponyms. These are just a few examples of the way in which archaeology, history and place-names complement each other. Wainright sought to show how the interaction of language, place-names and archaeology could bring out such historical events, even when they were invisible in archaeology alone.

The Choice of Appropriate Methods for Historical Archaeology

I now come to the first central theme, — the development and choice of suitable methods for tackling the problems raised by Early Historic archaeology. I cannot do more than outline some ideas on ways in which such methods might best be developed. My emphasis will be on the need for an open, flexible approach, beginning with an analysis of the site and the problems which it poses, and going on to the choice of appropriate methods for the purposes envisaged. I do not mean to suggest that the actual methods chosen are necessarily different from those used in pre- or proto-historic research, but rather to stress their wide variety, and the desirability that they should be selected and aligned to the particular purposes of a given project. Above all let me stress that the methods selected and employed are not the product of something learned by rote, and unthinkingly applied. Rather they should be chosen and used by the excavator after he has first thought through the approach to the site and the problems which he wishes to address. First of all, however, let me emphasise the fundamental importance of obtaining accurate stratification, correct sequences and relevant dates: so as to be able to establish a sound chronological framework for the interpretation of data.

The Importance of Chronology

The basis of chronology in archaeology, as in geology, is what has been called the Law of Superposition, that is the essential truth that deposits that are older are buried by deposits of later date, etc. For the archaeologist, no less than for the geologist, this means that he must analyse and understand the order and nature of the stratification within a site. From such stratification it is possible to determine the changes which occurred through time, as represented by study of the fossils or objects contained in such ordered strata. The application of the geological concept to archaeological contexts led to the early introduction of such terms as 'sequence chronology', and to the employment of 'type fossils' as aids to cross-dating from one site to another. However, it must be remembered that such cross-dating could still only provide sequence dates.

It was long ago recognized that to obtain an actual chronology sequence, dating must be linked wherever possible to absolute dating of one kind or another. The earliest attempts at such linkage were with history, through the medium of Greek or Roman coinage or inscriptions, and so on. An early extension of this linkage was the attempt to relate the Egyptian and Mesopotamian king-lists to other dating sources, particularly to the Bible, and thereby extend the possibility of absolute chronology back beyond the starting point of Greek or Roman chronology, and provide something approaching absolute dating for Mesopotamian and Egyptian archaeology. In India where such leads to absolute dating were virtually non-existent, or at best extremely limited, the celebrated cross-dating of Alexander's invasion of India to Chandragupta Maurya rightly became known as the 'sheet anchor'of Indian historical chronology. Beyond this, sequence chronology long remained the best that could be achieved in almost every early context. This accounts for the fact that there are still unsolved, and as yet insoluble, controversies over such fundamentally important dates as the Mahaparinirvana of the Buddha, or the inception of the Kanishka era. Sequence dating and the use of type fossils only become valuable when and as they can be linked to some form of absolute

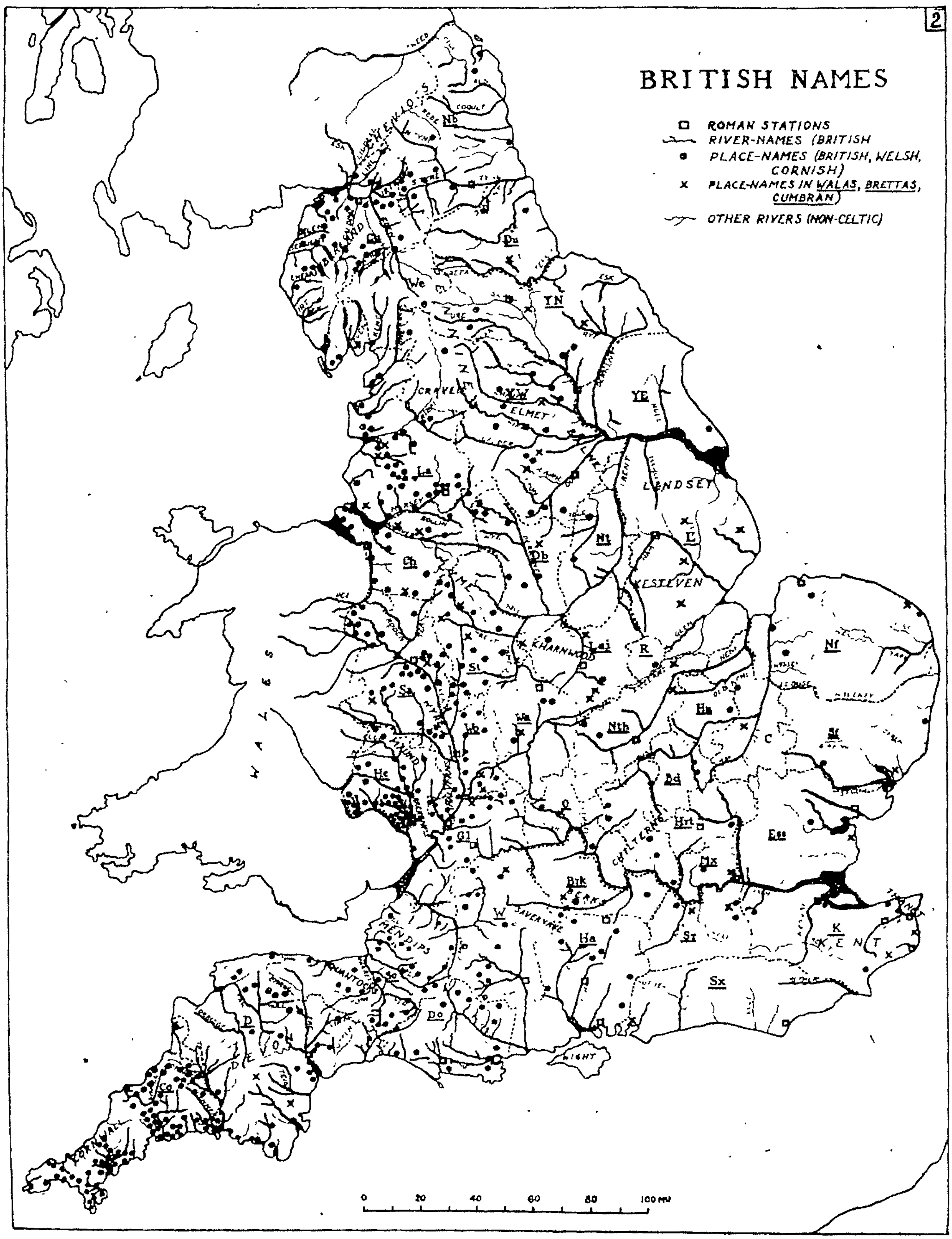

Fig. 5: British place-names of British, Welsh and Cornish origin: river names of British origin (in black) (after Smith 1956: map. 2)

chronology, and without it they are at best imprecise and cannot lead to the sort of chronological exactitude we need for the historical period.

It is here that science has been able to make a major contribution to archaeological dating, first through the discovery of the ^{14}C dating method by Willard Libby, almost exactly fifty years ago, and by a series of other scientific dating methods which are to date generally less useful for the periods we are discussing today. At first there was considerable resistance to relying on this new system, and to begin with there were many problems to be ironed out. Samples were often carelessly collected, and sometimes contaminated before ever reaching the laboratory. Many dated samples appeared to be inconsistent with each other, and the wide spread of dates seemed to raise formidable obstacles. In spite of this, my wife and I decided by the mid-1960s that, in default of any other means of absolute dating for South Asian archaeology, we should base our *Birth of Indian Civilization* (1968) on radiocarbon wherever dates were available. Since then the method has been considerably refined: dates may now be obtained from far smaller samples than originally possible, thus opening the way to obtaining larger numbers of samples than originally possible; the recognition of the need for calibration, and its subsequent refinement, mean that greater confidence can be placed on the radiocarbon dates, and the results are now sufficiently consistent for general use in providing a chronology for South Asian protohistory. In particular the recently introduced Oxcal programme appears to make radiocarbon dating a more generally user friendly tool and its results more accessible to the layman than hitherto (Brank Ramsey 1994). As a result, there is now a sufficient chronological data base for the Early Historic period, at least for some purposes. When I came to write on *The Archaeology of Early Historic South Asia* (Allchin *et al.* 1995), I soon realised that the relevant data base was not as comprehensive as it was for the earlier periods, and that there were serious weaknesses in the available evidence when greater precision was sought.

I venture to suggest that archaeologists should give more attention to how they may best exploit the chronological data which ^{14}C can supply. If we follow our problem-oriented approach we should not be contented with collecting samples in a random manner, but rather consider how to obtain samples appropriate for dating specific features, phenomena or events. It is often not enough to use random samples to provide clusters of dates for periods of several centuries duration, or to use the chronology thus obtained to define an equally imprecise chronology for a type fossil (such as NBP). Rather we should seek samples which may date actual events, such as building periods, recognizable periods of occupation, the first, or last, occurrence of significant finds, such as iron, Rouletted ware, coins and so on at a site. Dates are more likely to be meaningful when they relate specifically to stratigraphic or structural phases, and thus can be closely associated with the particular event or finds which they are intended to define. An intriguing example of this trend is offered by Bellwood when he obtained dating for cereals, using the actual seeds themselves as samples (Bellwood *et al.* 1992). In this way the establishment of a precise and accurate chronological framework appears to offer archaeologists, historians, epigraphists and numismatists alike, a most valuable tool for the Early Historic and even for later periods.

Survey

Archaeology is more than the mere identification of artefacts; rather it is the study of man and his culture. Man is a social being and lives in communities, and thus archaeology must also be concerned with the recurrent phenomena of societies and with such aspects as their social structure and economic bases. In approaching such matters an extensive, geographical, perspective is called for, and this can be best supplied by various types of archaeological survey. In many environments the methods known as 'remote sensing', that is by means of satellite imagery and aerial photography, can be powerful aides to extensive survey, and provide valuable assistance for the archaeologist who is fortunate enough to have specialists in this work to hand. This is something which certainly needs to be developed in India, even if only on a limited scale. The needs of aerial photography have scarcely been recognized or begun to be used in India in the service of archaeology. As an adjunct of large-scale surveys aerial photography has immense potential; and it is up to archaeologists to try to find ways in which this might be achieved.

Even without aerial photography, land based surveys can produce remarkable results in some situations. We should recognize the difference between the pre-Baconian approach to survey, simply hunting for sites and recording them, valuable as this may be at one level; and a problem-oriented approach, when the survey is conceived in a specific cultural context, and work is linked to clear objectives, seeking the answers to specific questions. Even here there is a wide choice of strategies available, and we need to select appropriate ones for the task in hand. There are a number of good examples of such surveys at work in South Asia: Dr. Mughal's project in the Cholistan desert in the 1970s (Mughal 1997); Dr. Makkhan Lal's (1984) and Dr. Erdosy's (1988) surveys in the Ganga-Yamuna Doab; J.P. Joshi and his colleagues' surveys in the Saraswati and Drishadvati valleys (Joshi *et al.* 1984; Joshi 1993). Such work suggests the scope and importance that settlement surveys can offer as a tool for archaeological research. Furthermore, their role as a preparation for choosing sites for subsequent excavation cannot be overestimated. One might hope that no excavation should be undertaken unless or until a proper survey of the region has been completed.

A second aspect of terrestrial survey concerns work at individual sites. One useful method, which has been little used in South Asian archaeology, may also be referred to as remote sensing, although it is more often spoken of in terms of the actual method employed, i.e. by means of electrical resistivity, proton magnetometers and allied methods. Yet another useful adjunct is by probing with the aid of earth augers. Such methods can provide quick and economic ways of discovering data without the time, expense and labour of excavation: for instance, to find what types of deposists lie beneath the surface in a site, extending a known stratigraphic sequence more widely, extending or verifying the results of limited excavation. I believe that in the context of modern South Asia where population pressures are leading to the rapid and often total destruction of sites, these methods have a very important role in what all too often is becoming a race against destruction.

Finally one should not forget the role of submarine archaeology, even if this is a relatively more costly and necessarily restricted research tool. There are enough examples from around the world to suggest that exciting finds may be made by such surveys.

Excavation

Excavation should be more than just digging holes in the ground, even when proper regard is had for stratification. The first questions which should be asked are : Why excavate?, Why this site?, What do I want to learn from excavating here? Excavation needs to be properly planned and problem-oriented, taking into account whatever knowledge is available regarding the site and its cultural context, so that nothing is done blindly, merely for the sake of digging, but rather in response to specific problems which the excavator has already formulated and seeks to find ways of answering. Once excavation is in progress the excavator will obviously need to reassess these aspects as work proceeds.

a) The excavation will vary depending upon the nature of the site and of the problems posed. For example, in excavating a large settlement or city the cutting of a section through the rampart tells us little beyond the chronology of that feature, and the military architecture employed. Again, in excavating a city, small (10 m^2) sondages such as those chosen by Deraniyagala at Anuradhapura can provide little more than a rough sequence at each spot chosen. Much larger areas need to be excavated, and attempts made to discover details of the layout of streets and houses within such cities. It is really sad that more archaeologists in South Asia did not follow Sir John Marshall's lead in excavating whole houses and even streets, as at Bhita, Taxila and Mohenjo-daro. We have scarcely begun to work out excavation methods tailored to this type of work. For it, suitably extensive areas should be chosen and excavated layer by layer, without the frustrating presence of residual grids of baulks. Such baulks are all too often hindrances to a problem-oriented approach, and reduce the area available for proper excavation; without them rooms and larger structural complexes may be studied as complete entities rather than in disparate parts, etc

b) Excavations should not be restricted to one type of site, any more than to one type of excavation procedure. No one has yet sought to discover the military encampments referred to in the *Arthasastra*, but if they were able to do so, they would have to reckon on a combination of deserted earthworks, and temporary structures probably represented by no more than post-holes, and this would call for suitably adapted excavation techniques. Should a project be launched to study Early Historic or Mauryan fortifications the methods would obviously centre upon evidence of ditches and ramparts, and their immediate vicinities. They might also provide all sorts of insights into early military methods and planning, currently known exclusively from textual data.

c) Industrial sites of all kinds offer most exciting prospects for research. One may cite the example of Craddock *et al.* (1989) and the late K.T M. Hegde (1991), where a series of copper, lead and zinc mines were reported to have been discovered, and dated by radiocarbon to the Early Historic and Medieval periods. The investigation of such sites clearly calls for specialised knowledge and experience from professional experts in mining engineering, and for scientific analyses and expertise in the field of metallurgy. Another recent example of such work in South Asia is afforded by Dr. Gill Juleff's study of a unique iron smelting process at Samanalawewa in Sri Lank, where hilltop positions were chosen, so that smelting could be carried on by wind power without the aid of artificial draft (Juleff 1997: 901-10).

d) Excavation has clearly a major role to play in the study of early historic agriculture, pastoralism and irrigation. Archaeologists of the historical period have been slow to recognize the potentialities for research on the lines, for example, of Paddayya's excavations at Budhihal, where an entirely new perspective has been thrown upon the cattle economy of this Karnataka Neolithic-Chalcolithic site. It is clear that these aspects are ripe for study, and that archaeology must have a major role to play in doing so. The study of irrigation works surely also has enormous potential. There is, it seems to me, ample room for developing methods for dating stuctural phases of tanks and sediments, and thereby extending our knowledge of the function of irrigation in early historic society and its economic implications. The importance of linking such evidence to textual and epigraphical data is very clear; one has only to think of Brohier's work in Sri Lanka (1934), the late R.N. Mehta's study of the Sudarsana tank at Girnar (1968: 18-28), and the recent study of water resources at Vijayanagara (Davison-Jenkins 1997), to grasp what awaits the purposeful, problem-oriented archaeologists.

e) We should also mention the role of excavation in the study of religious structures and institutions. Useful attempts that have been made to identify the sectarian affiliation of Buddhist monastic complexes, from study of the layout and relationship of the various structural structures at a site, stupas, monasteries and caitya halls (Akira Hirakawa 1963; Rosen 1980). These same methods may be used much more widely for obtaining a fuller understanding of any religious structure. For instance, the earliest Vaishnava shrines, at Vidisa and at Nagari, are cases where far more significant information might have been obtained had a problem-oriented approach been used for the excavations. Another example of the use of archaeology to study an early Saiva site is provided by Sarma's work at Gudimallam (1982). The study of a site such as that left exposed by the destruction of the Babri Masjid needs to be undertaken in a spirit of detached scientific enquiry.

The Study of the Finds

Just because an excavation is of a historical site, there is no excuse to neglect the proper study of the finds. Here again, the need for wide inter-disciplinary collaboration is clear, and the pattern which can be found in many pre- and protohistoric reports is certainly worth following. The nature of the data will depend to some extent upon the breadth and nature of the excavator's problem orientation, and the availability of experts to collaborate in the study.

a) The collection of plant and animal remains has produced spectacularly interesting results for the later prehistoric periods, and certainly needs to be pursued into the Early Historic. K.N. Dikshit's excavations at Hulas (1982), and Purushottam Singh's excavations at Narhan (1994), for example, are greatly enhanced by the study of the plant remains. Indeed, K.S. Saraswat's (1993,1994) lengthy analysis of the major food grains, other plants and trees discovered in these excavations, provides a vital dimension of our understanding of the process of population growth and the complex new pattern of mixed agriculture that lay behind the rise of the cities of the Ganga Valley. We need to know much more than the straight identification of plant types and animal breeds, and to be able to reconstruct other aspects of the structure and methods of food production and distribution. How far we have come since the almost complete neglect of this kind of data in excavations of the Wheeler Age!

b) Crafts and industry have received more attention for the earlier pre- and protohistoric periods; but here too there is great scope for extending the study into the historical periods, not only in terms of the history of science and technology, but also of the social and economic aspects of industrial activities, including such matters as distribution and trade. In this context a few examples only need be cited to indicate the sort of interest which such studies hold: there has been considerable interest in the history of carnelian working, beginning with Mackay (1937), B. Allchin (1979), and more recently Kenoyer *et al.* (1994). We cited above the exciting new information archaeology has provided on the production, smelting and working of various metals (Hegde 1991; Juleff 1997; Craddock *et al.* 1989); also Hegde *et al.* (1982) on the manufacture of Harappan paste micro-beads; the discovery of the stone quarries at Chunar where many of the Asokan pillars were produced (Pant and Jayaswal 1990), are a few examples.

The study of pottery deserves to be followed in the interests of gaining greater insight into the technical aspects of the craft and the economic and social aspects of the products. The over-emphasis placed on pottery typology in many earlier publications was justified in the days before radiocarbon dating was established, as providing the principal means of establishing sequence dating for many sites, but subsequently seems to have little to offer for the problem-oriented approach. Moreover, studies of its chronological utility indicate that the typological analysis of pottery must be accepted as a blunt tool when compared with certain other categories of artefacts such as coinage or dated inscriptions.

The Interface of Archaeology with other Subjects

I come now to my second major topic, the interaction of archaeology, in a general way with branches of science, and in a more particular way with what I have called the ancillary disciplines, history, epigraphy and numismatics. At the outset let me repeat my view that archaeology has a special propensity to devise research programmes and methods along lines which in many ways parallel scientific experiments. In this respect it has a peculiar advantage over the ancillary disciplines. It has a unique ability to discover new data, some of which may be relevant for the ancillary disciplines. Without the intervention of archaeology, the discovery of new data for the epigraphist, numismatist and historian of art or architecture is all too often as a result of chance finds, for instance during road or house construction, or by treasure seekers. Such data, whatever its intrinsic importance, inevitably suffers from lack of precise information regarding the site and context of the find. Full and satisfactory data on these topics can be supplied by archaeology alone; and is likely to be most valuable when it is the product of problem-oriented research projects.

There is another way in which archaeology and science are linked: because the modern archaeologist depends upon a whole series of scientists to contribute to specialised aspects of his work. Where would we be without radiocarbon and other forms of scientific dating? We need specialists in geology and geomorphology; palaeobotany, palynology and palaeobiology to study ancient plant and animal remains, as well as human skeletal remains; studies in climatology; studies of almost every branch of ancient technology. All such work can benefit from the co-operation of appropriate branches of science and often of modern technology; and so on, the list is potentially very extensive.

Thus historical archaeology needs the co-operation of scientists as well as of specialists in the ancillary disciplines. The need for such widespread co-operation is as great for the archaeology of the historical periods as it is for prehistory or protohistory. The role of the historian is an essential one, but all too often the quantity and quality of narrowly historical source materials are such as to seriously restrict the scope of early Indian history. The situation of historical data for British Dark Age history is very comparable. As a result, there are bound to be many unanswerable questions posed for the historian in such contexts, and this points towards the value of using archaeology to provide new, problem-oriented research, discover new and relevant facts and thus to contribute to reaching newer and wider solutions.

When I speak of the interface of archaeology and history I am using history in a wider sense than narrowly political history. Thus in addition to epigraphy and numismatics, economic history, the history of science and technology, of agriculture and irrigation, architecture and of art. I believe that we should try to bring these diverse subjects into fruitful collaboration, so as to achieve a wider appreciation of their roles in relation to one another.

I now wish to concentrate on some aspects of the interface of archaeology with history, and particularly with epigraphy and numismatics.

Archaeology and Epigraphy

The presence of written records is an essential element in the reconstruction of history, and for the early period this involves also the ability to read the scripts. Thus epigraphy becomes a vital subject for both archaeologist and historian alike. But there are also fundamental differences in the methods employed: the epigraphist may be able to carry out searches, seeking hitherto unknown inscriptions, copying them and reading them; and should certainly be able to handle inscriptions discovered by chance; but in both these activities there is a largely random element in the inscriptions discovered. The archaeologist on the other hand has a much wider choice of research programmes and particularly because he plans his research in 'experimental' or 'problem-oriented' terms he may succeed in obtaining more significant new data than can the epigraphist working by himself. I shall now give some examples to indicate what I have in mind.

The Harappan script

The excavations of the 1930s established that the earliest inscriptions in South Asia were associated with the Indus Civilization, and were written in the Harappan script. It did not take many years before a suggestion was made that certain pots which bore single incised marks were perhaps slightly earlier than the script and might have provided its initial inspiration. The current American-Pakistani excavations at Harappa have revealed the clearest indications to date of the origins of the use of writing in South Asia (Meadow and Kenoyer 1995). During the final centuries of the Early Harappan period the number of pots with inscribed graffiti gradually increases; and the first example of what is undoubtedly an actual Indus inscription occurs around the year 2600 B.C.. This then is a good example of the way in which controlled archaeological excavation, linked with adequate ^{14}C chronology can provide the solution to a long obscure, and never clearly defined problem. A further example of the usefulness of sound problem-oriented excavation is provided by the way in which the recently discovered inscribed materials from Harappa indicate that during the centuries of its currency (i.e. from c. 2600-c.1800 B.C.) the script was not altogether static, but shows some evidence of development and stylistic change as well as variation in the types of object on which it is employed. The publication of this aspect of the excavations at Harappa is eagerly awaited.

The early history of the Brahmi script

After the initial discovery and reading of the Brahmi and Kharosthi scripts in the early nineteenth century, there followed a long period in which little new data emerged regarding their origins and early history, although several new theories have been advanced. Surprisingly, until quite recently, little attempt has been made by archaeologists to address this problem in a problem-oriented manner. The recent excavations at Anuradhapura offer another example of the way in which archaeology can contribute to the understanding of such problems.

Between 1985 and 1989 Dr. Siran Deraniyagala (1990,

1992) and the Archaeological Survey of Sri Lanka excavated thirteen small sondages, each of three metres square, widely distributed over the 100 hectare citadel mound, reaching a maximum of about 9 m in depth. The aims of this work were to provide a broad stratigraphic sequence for the city as a whole, and chronology derived from an adequate collection of samples for radiocarbon dating. A quite unexpected discovery was of numbers of potsherds inscribed with short inscriptions in Brahmi. I for one was at first frankly sceptical when their age, in terms of the radiocarbon dating became known. Moreover I believed that, with all the care in the world, such restricted trenches, carried down to such a depth, must involve a considerable risk of inaccuracy and uncertainty regarding the stratification of individual small finds. To some extent this doubt remains and therefore puts a question mark, not so much on the absolute chronology, as on its relationship to individual sherds. We were therefore very happy when Dr. Deraniyagala invited myself and my former student Dr. Robin Coningham to carry out a complementary excavation (ASW2) of 100 sq m alongside one of the sondages (ASW1). This scheme justified our expectations, in that it provided excellent stratigraphical evidence, clearly linked to a structural history going through many building periods, which in turn yielded a fair number of radiocarbon samples. Obviously we were forewarned to look out for the appearance of scratched signs and inscriptions on the pottery, and here too the results were most exciting In what follows I shall use the chronology and stratification as it emerged in this excavation of site ASW2 (Coningham *et al.* 1996).

This is not the place to enter into a discussion of the considerable divergence of the dating of early inscriptions between Dr. Deraniyagala's sondages at Anuradhapura and our own excavation. As I have just remarked, it is not that the dates themselves are in any way implausible, but that they do not in all cases appear to relate happily with the inscribed sherds. Thus of five examples from the AMP sondage, from a context dated c. 700-500 B C., at least one has a script style which we would incline to date, epigraphically, to the third-second century B.C.; similiarly of two examples from ASW1, from a context dated to the same period (c.700-500 B.C.), one sherd has the archaic character we associate with our early inscriptions (late 5th-early 4th century B.C.), while a second has a script style which, epigraphically, we would expect to belong to the 2nd-1st century B.C. In our excavation too there are some apparent anomalies between ^{14}C dating and stratigraphic context; just as in both excavations there are some apparent anomalies in cross-dates to inscriptions on early caves, etc. But a sufficient number of the inscriptions are consistent with the main developmental sequence of the script style as we understand it.

From our excavation (ASW2), the occurrence of scratched marks or graffiti at the site began in an early phase of period J and is probably assignable to c. 450 B.C. The symbols are in many cases similar to those found on Iron Age Black and Red ware pottery, both in megalithic graves and in settlements throughout the Peninsula. At Anuradhapura, the symbols continue from that time forward, into the early centuries of the Christian era. A peculiarly interesting feature of this series was that one sign, which we called 'the dominant symbol' along with a number of variants, occurred on some 70% of the total number of graffiti bearing sherds. The earliest Brahmi inscriptions occur some fifty years later, c.400 B.C., and around sixty examples were discovered , belonging to the next four or five centuries. Wherever the language of our inscriptions is identifiable it appears to be Prakrit. It is noticeable that none of these inscriptions have the characteristic hallmarks of the early Tamil adaptation of the Brahmi script, so well analysed by Dr. Mahadevan and found, for example, at Arikamedu, Uraiyur or Kodumanal. Not unexpectedly the script shows a clear evolution from large and inexpertly formed letters at the beginning, to more fluent and well formed letters in the third-second centuries B.C., and to yet more controlled inscriptions towards the end of the series, in the first centuries B.C.-A.D. It is these features which suggest what I have referred to as 'epigraphical dates' as opposed to radiocarbon dates.

Here then for the first time we have archaeologically recorded and scientifically dated examples of Brahmi script over several centuries. But it is clear that we cannot tell from the finds of a single site whether this was the beginning of the Brahmi script, or whether it had developed earlier in some other region or regions of India, and so on. I suggest that the further investigation of this matter offers a great challenge to archaeologists in India and Pakistan to seek for equally well dated evidence from comparable excavations at carefully selected key sites in the Ganga Valley, perhaps the northwest region, Orissa and elsewhere, to see whether comparative light can be thrown upon this aspect of the problem of the early history of the Brahmi script.

The history of the Kharoṣthi script

It would be very interesting to try and extend the same research method to the Kharoshti script. One would expect that its early occurrence would be in the northwest, in Pakistan in particular, and it would be very interesting to have an equally clear excavated sequence from another major site, where it might be seen whether and at what date the earliest Kharoṣthi occurs, and whether there is evidence of Brahmi overlapping with it in the early stages or not. My expectation is that Kharosthi was developed by Aramaic using Achaemenid clerks, and that its adaptation to written Prakrit provides an indication that Brahmi script, along with the phonetic analysis of the grammarians, must have been already in existence at that time. With a co-ordinated research programme I believe that new light could be thrown upon the origin, spread and relationship of these two scripts, and the dates at which they occurred, as also the probable regions in which they first developed.

Inscriptions as a source of data

It has long been accepted that inscriptions, particularly when they are dated or datable, play a major role in establishing the dates of the monuments on which they occur. In the case of some of the great temple complexes of South India, at Tirupati for example, an almost complete history of the temple and its growth and renovations can be obtained from the many hundred inscriptions carved on its walls. Even when inscriptions are not precisely datable, for instance upon the railings and pavements of Stupa 1 at Sanchi or Bharhut, we feel a sense of reassurance at being able to read the many dedicatory inscriptions and learn the trades or professions of the donors, and the cities from which they hailed. But how extraordinary it is, how peculiar to the countries of South Asia, that after so much work and so many years we are still unable to date accurately the original construction or the subsequent enlargement of these and many other early monuments!

The accurate dating of the Sanchi or Bharhut stupas has been noticeably lacking for the past century, and it is worth considering whether we can supply any new evidence. I suggest that archaeologists take up this challenge and apply a problem-oriented approach to try to find ways of obtaining archaeological dating in such cases. The Anuradhapura excavations suggest a few examples of one approach which might be employed. In a pit of ASW2, period H, a horizon well dated to c. 200-100 B.C., a clay sealing was found, with the Brahmi inscription *tisa puta magaha parumaka*, Magaha, the chieftain (*parumaka*), son of Tisa. A few miles from Anuradhapura the hill monastery of Mihintale was established in the late years of the reign of king Devanampiya Tissa (i.e. c. 207 B.C.), and there are many caves excavated during the subsequent decades and inscribed with the names of those who dedicated them to the Sangha. Cave 22 includes a donation from a person named as *badarika parumaka Magaha tiśa puta* (the treasurer chieftain Magaha). It is one of a group of caves belonging to the succeeding reign of king Gamini Uti (207-197 B.C.). There seems to be a strong probability that the two Magahas are one and the same person, and if so provide an exciting cross-dating point from radiocarbon chronology to historical and inscriptional chronology. Incidentally the Anuradhapura excavations also produced inscribed potsherds referring to several royal ladies, *Tiśa Abiya, (A)bi Anurādha* (perhaps *Anurādhi*, the sherd is broken at the point), *(A)biyasahāsini*. These titled names are also known from cave dedications at Mihintale and other places in Sri Lanka. This raises an intriguing speculation: the ASW site is situated near the centre of the city which had became the capital of the kingdom, and was therefore located on or near the traditionally likely site of the royal palace. Therefore it is perfectly possible that the names of (mainly female) members of the royal family might be found there, inscribed upon pots, either used for domestic purposes or for the storage of precious possessions.

Sri Lanka is peculiarly well placed for the exploitation of archaeology in the service of history: in addition to the very large number of early inscriptions there are the chronicles, the *Mahavamsa* and the *Dipavasma*, which provide a degree of historical data un-parallelled in early India. But the absence of comparable chronicles should not deter us from seeking other ways in which excavation could help to make good the many lacunae in Early Historic archaeology in India and Pakistan. One feels great regret that a city such as Mathura, from which so many dated inscriptions have come has not been the scene of more problem-oriented attempts to identify and excavate some of the institutions they refer to; or that the Hadigaun area of the Kathmandu valley, from which come so many important inscriptions referring to the Licchavis palace and capital, was not properly explored and excavated while the area was still mainly open: now unfortunately much of it is covered with modern housing development.

Archaeology and Numismatics

In the west the study of numismatics early became a prime source of chronology for archaeology and history alike. This process was aided by the fact that coins were in large part inscribed with the names of rulers and were thus able to be interrelated with other forms of historical dating. Throughout South Asia a very different situation prevails: many early coins are without clear royal attributions, many without inscriptions, and even when a king or dynasty can be assigned all too often the exact chronology of the ruler has still to be fixed and agreed on. In most Roman excavations coins provide a sound means of dating archaeological contexts, but all too often in South Asia they provide no such assistance. Rather it may be left to the archaeologists to offer dating support to the numismatists. With a well and consistently dated sequence such as that we have reported at Anuradhapura there is a real possibility of providing answers to some of the longstanding questions of Sri Lanka coin chronology. One regrets that Marshall's excavations at Taxila were in some respects a wasted opportunity, in that the lack of more carefully defined stratigraphy and the absence of anything akin to radiocarbon dating led to the confusion long since commented on by ourselves and others (Allchin 1968) In spite of these reservations, there can be no doubt of the usefulness of the very large number of identifiable coins discovered by Marshall's Taxila excavations, once the presence of a small percentage of 'stray' finds is admitted. There is now a growing body of sites throughout South Asia from which coin finds have occurred in well stratified contexts, and here there is a continuing need to provide more accurate dating, through the medium of radiocarbon. Attention has been drawn to the unclear stratification in certain cases (for instance in G.R. Sharma's excavations at Kaushambi), where the excavator failed to distinguish between finds from regularly sealed deposists, and those from wash deposits lying above the brick ramparts. Here too, a reassessment of the evidence is called for, to obtain a more realistic chronology for the coin finds at that site. What is still badly needed is closer colaboration between archaeologists and numismatists in such contexts. How this may be achieved has to be considered, but we believe that a starting point should be in more focussed and problem-oriented excavations.

Archaeology and the History of Architecture and Art

I do not want to spend long on this topic. Obviously, the history of monuments plays an increasingly important role in the study of settlements and cultures of the historical period, and therefore archaeology and the history of architecture become closely intertwined. Moreover, a little judicious excavation can help to elucidate the history of a building and its antecedents. A good example of this is provided by the four 'Asokan' stupas around the entrances to the city of Patan in the valley of Nepal. So far it has been impossible to excavate in their vicinity, and so the question of their origin and whether they are indeed Mauryan hangs on tradition and faith alone. From our point of view this amounts to a negation of the principle of scientific enquiry and evidence. One could wish that a detached spirit of enquiry might be brought to bear on many such difficult questions. For instance, the destruction of the Babri Masjid (something of which no conservationist could approve), might be seen as providing an opportunity to conduct an unhampered and systematic excavation to investigate the site's earlier history, for how long it has been a cult spot, and for which religions or cults, in particular whether there is any objective evidence for its claims to be the birthplace of Sri Rama.

It is often claimed that archaeology is quite distinct from art history, and these days there is a tendency among archaeologists to belittle art historians, as mere collectors or even motivated primarily by financial interests rather than scholarly. I would dispute this view most firmly. I regard art history and archaeology as sister branches of the study of human cultural achievements, and as properly a field for collaboration between members of a family. It may be that each has its own defined sphere, but there is no doubt that, as with history, epigraphy, numismatics and architectural history, there is ample room for the two subjects to help one another.

I will cite only one example of the way in which archaeology can help to provide chronology for works of art. When we consider the great numbers of terracotta figurines which occur in Early Historic contexts from the North West Frontier Province right across to the Ganga delta, we realise that it is primarily through their discovery in excavations, from Charsada, Shaikhan Dheri and Taxila in the northwest, through such sites as Ahicchatra, Kaushambi and Bhita, to Patna and Chandraketugarh in the east, that their chronology can be established. Where excavations with accurate stratification have been conducted, a clear sequence emerges to which broad periods can be assigned; where the stratification was only vaguely or incompletely established, the sequence and chronology of the terracottas remains correspondingly vague and unsatisfactory. From this it follows that archaeology can make a powerful contribution to the dating of art historical styles and sequences, through the agency of properly conducted excavations. Another good example of the role of excavation in the establishment of the chronology and stylistic evolution of art styles, is presented by the Gandharan art of Pakistan. Here only slowly has a proper chronology been established, and the need for more accurate excavations, and for proper publication of their results is as evident as in the case of the terracottas.

Speaking as one who regards himself primarily as an archaeologist I must admit to sharing doubts about some of the methods used by art historians Moreover, the archaeologists' links with science give us a great advantage over the more 'humanistically' based art historians. But, we must admit the right of the art historians to pursue their own discipline, with its established methodology, and we must certainly recognize the desirability of collaboration between the two disciplines.

Archaeology, Ethnoarchaeology, Living Traditions and Place-name Studies

Finally, I may mention the wide and diverse interaction of archaeology with living traditions, including craft traditions, place names and other verbal traditions as areas where archaeology can fruitfully collaborate in research. India is a splendid region for such collaboration; the longevity of living traditions is so frequently borne out by subsequent archaeological discoveries. One may cite the excavations at Hastinapura and other sites whose ancient names are still remembered; the discovery of the Ghoshitarama inscriptions, starting with an Ayagapata of the first century A.D., in the monastery site at Kaushambi which incidentally provides too the early archaeological proof of the name of the city itself. Another aspect of this use of living traditions is to be sought in the evidence of the antiquity of craft techniques which flourish today and are in evidence in much earlier times. The studies of the carnelian bead industry at Cambay (Khambat) and elsewhere to which I referred above offer another example of this remarkable continuity of tradition, on the craft side.

I should also like to mention the need in South Asia to pursue place-name studies at a more systematic level than hitherto. In many parts of northern Europe systematic studies have been made not only of all names of settlements from modern times back, but also of house and field names. In the course of these studies many interesting facts emerge relating to earlier history or, for example, to the spread of the Anglo-Saxons and Danes in Britain in the middle centuries of the first millennium A.D., and I believe that further work in South Asia could produce much material of this kind.

My own interest in this subject began many years ago while we were working in Karnataka. I noticed the way in which certain hills which gave evidence of early settlements also frequently had certain patterns of toponym. When we were pursuing the study of the ash mounds, and excavating at Utnur in the late fifties I became further struck by the way in which certain place names, and even certain living traditions, already had a clear idea of what the original function of the mounds had been. When we discovered the floors of cattle pens, bearing the impress of hooves of some four thousand years ago, the local people were as excited as we were, because these things bore out their own traditions. South Asia abounds with examples of names which can claim equally great antiquity.

Some Problems Awaiting Solutions

I now wish to draw this talk to a conclusion. I believe that the development of appropriate methods for Early Historic archaeology needs to go hand in hand with intelligent, problem-oriented research plans, and with an openness to co-operation with specialists in whatever branches are appropriate. If any single thought underlies this talk it is that the more widely such co-operation can be achieved, of archaeologists with one another, and with scientists, historians, numismatists and epigraphists, the better will be the prospects for fruitful progress. It is not possible here to begin to list the variety of problems which may be tackled, these will suggest themselves to scholars working in the field. But, as a start may I suggest one or two topics?

During the past fifty years some outstandingly important sites have been neglected by archaeologists at a time when population growth and development have led to their being rendered largely lost to excavation: such a case is Pataliputra. This city must have been one of the greatest in Asia in the Mauryan period, and yet we know virtually nothing about its archaeology. Long ago, it was left to an amateur, Waddell, to attempt to identify the wooden ramparts referred to by Megasthenes; and then to a Parsi industrialist to offer the Indian Government money to finance excavations by the Archaeological Survey at Kumrahar. The excavations carried out in the past half century have been on an almost derisory scale. No comprehensive survey of the ancient city has as far as I am aware ever been carried out at Patna; nor has any wider scheme of carefully chosen and planned excavations ever been drawn up. Certainly we need another patriotic industrialist or group of industrialists to underpin the work. Equally, we need an enlightened successor to Lord Curzon to come forward from the side of Government, to spur the ASI to drawing up and discussing the details of a master plan for research, and for thereafter marshalling whatever resources are available. Probably the project should be planned with the active co-operation of Central and State Departments of Archaeology, Universities and other non-governmental agencies, and perhaps too allow for international collaboration. Today many of the opportunities of excavation, which were still practical when we first visited Pataliputra fifty years ago, have been lost. But the fact remains that a carefully planned and executed, problem-oriented approach to ancient Pataliputra is still possible, and should be able to produce extraordinarily interesting and important results. Many of the same remarks apply to Rajagriha. The previous capital of Magadh, from the time of the Buddha through to the shift of Patalipurta, is archaeologically largely *terra incognita* and equally calls for an integrated problem-oriented research program. Between these two sites archaeology should be able to throw light upon the archaeologically almost unidentified Nanda dynasty, and provide a better understanding of the rise of the Maurya dynasty.

I mentioned above the unsolved problem of the date of the Mahaparinirvana of the Buddha I am convinced that archaeologists should give thought to ways in which they might contribute to a solution of this matter. The probability that the Jetavana monastery at Sravasti or the Ghoshitarama at Kaushambi, date back to the time of the Buddha leads one to expect that problem-oriented research there might supply useful answers; so too might sensitive investigations at other great Buddhist sites, such as Bodh Gaya or Sarnath. Here indeed is a prize worth seeking! Equally in need of solution is the date of the inception of the Kanishka era, but the solution of this problem is more likely to be found in Afghanistan or Pakistan, than in India. The recently reported chance discovery of a substantial stone slab inscription in northern Afghanistan, at Rabatak, on the road about midway between the Kushan dynastic shrine at Bagolango (modern Baghlan), and the important monuments at Haibak. The inscription is written in Greek script, in the Bactrian language, and refers to the great king's promulgating the *year one* (presumably of his era), and sending a message to this effect to the cities of India, including Saket, Kaushambi, Pataliputra and Sri-Campa (Sims-Williams and Cribb 1996). This suggests that, could its find spot be ascertained, it would be a prime choice for such an investigation, once peace returns to that troubled land.

India has enormous resources of talent and expertise and I am sure that with a little more constructive thought, a little more co-ordination of effort, a little more of a problem-oriented approach, and a little more marshalling of available resources, great progress could be made. The foundations so well laid by Cunningham, Marshall and Wheeler; and the giant stepts that have been witnessed during the past five decades, with the contributions of such scholars as H.D. Sankalia, G.R. Sharma, B.B. Lal, B.K. Thapar, and other dedicated workers too many to mention by name, now provide a basis for the flowering of a quite new and enhanced archaeology of the historical period.

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Whither South Asian Prehistory?*

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Introduction

The fiftieth anniversary of Independence provides an opportunity for looking back over past developments and achievements in the whole field of Indian prehistory, and that of South Asia as a whole, and, more importantly, for considering the future. Recent developments in the relationship of India to the outside world perhaps also make this a particularly appropriate time for such considerations.

The title of this paper is Whither South Asian Prehistory, and I must make it clear from the outset that this is because the emphasis will be on prehistory. But in terms of concepts, approaches and techniques one cannot draw a line between archaeology and prehistory: they are part of the same discipline the aims of which, as is generally agreed, were initially to extend our understanding of the cultural development of the human race by studying the physical remains of past cultures. As time has gone on new techniques have become available, and as understanding of the subject has deepened, the scope and aims of archaeology and prehistory have extended, in parallel with, and increasingly also in collaboration with, other disciplines. Later archaeology obviously has close links with history, epigraphy and numismatics. The history of art and architecture is closely interrelated with both archaeology and later prehistory. Various branches of palaeobiology now play an important part in understanding all periods of the past. In the study of earlier prehistory, geology, geomorphology, climatology, soil science, palaeontology and related subjects all play an essential role. Physics, basic to so many of these fields, plays a direct role in much archaeological research today through the many methods of physical dating now available.

What I propose to do today, therefore, is first of all briefly to survey the development of the study of prehistory as a branch of archaeology in India, and in South Asia generally, and then to put forward some thoughts as to what the future may hold. In doing this I am not attempting to foresee the future, or to lay down the law about what other people ought to do. Rather, as an outsider long familiar with the Indian archaeological scene, I am trying to take an overview of the situation, and to throw out some ideas in the hope that they may stimulate discussion and further thought.

The Archaeological Tradition

In its early stages archaeology in most parts of the world, including India, often consisted in exploring and excavating ancient sites in search for antiquities and objects of interest to put in private collections and Museums, and the process was often destructive, as for example by breaking into Megalithic graves and Stupas in search of treasure. Similarly in its early stages the basis of research in earlier prehistory, — the study of the Stone Age, — chiefly consisted in the collection of stone artefacts from surface sites and river gravels, often without making any attempt to record their precise position in a site, or their relationship to other features. This activity sometimes resulted in the removal of virtually every transportable artefact from a site, — a situation to which many of us have contributed in our younger days. Steadily, however, archaeology came to be regarded as a means of finding material by which cultural phases of the past could be recognised, sequential relationships between them established and different building periods and other changes observed. In some parts of the world regularly inhabited caves and rock shelters were excavated and yielded sequences of Stone Age and later cultures which demonstrated the technological development of stone artefacts. Like material recovered from sites of other kinds, the artefacts could be seen as demonstrating the increasing skills and abilities of the human race, in an almost evolutionary sense. In South Asia, however, with the exception of Sri Lanka and northwest Pakistan, there are few caves; and the rock shelters found in a number of regions only rarely yield early material. This situation has presented many problems for prehistorians, and for some time held up research, but it has also stimulated thinking in ways that in the long term will probably prove to be beneficial to the subject.

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* Presidential Address delivered at the XXV Annual Conference of the Indian Society for Prehistoric and Quaternary Studies, Srinagar, Garhwal, 16-18 October 1997

As time went on and more questions were asked about the cultures of the past, excavation in both India and the west became more systematically organised and more carefully recorded, although still, in terms of the way we look at things today, rather wasteful and destructive, and often lacking in focus. This is very striking when one looks for example at Knossos in Crete, excavated in the first decade of the present century, — which also incidentally appears to have suffered some rather imaginative reconstruction. The late nineteenth and early twentieth century were the heyday of large-scale excavations in many centres of ancient culture, particularly in the eastern Mediterranean and Western Asia, usually under the direction of a single dedicated archaeologist who often commanded considerable funds from private sources or from museums or other public institutions. These were the days when in western countries taxation was much less heavy than it is today, and death duties almost non-existent, and wealthy individuals could and did finance excavations either directly or through institutions such as museums.

In pre- and early post-Independence India, too, major excavations continued to be the principal focus of archaeological investigation into the present century. Large-scale excavations were done at important sites with the object of gaining an understanding of their nature and layout, and discovering their cultural sequence and the major buildings and outstanding objects they contained. This was regarded as the proper way for archaeological research to proceed in India, as it was in Crete, Egypt and many other centres of ancient civilization. In India it was carried on by the Archaeological Survey, alongside the detailed recording and conservation of major monuments, and increasingly as time went on excavations were carried on by other institutions, particularly universities. The concept of systematic excavation, aimed at obtaining a fuller picture of the cultures represented by the various periods of occupation of a site, was developed in India, initially with the support of Curzon, by John Marshall, Vats and others. Much of this work was magnificently published in great detail in large well illustrated volumes such as those of Marshall, Vats, Mackay and others which form the basis of our knowledge of the Indus Civilization and some of the early city sites of the Ganga plains such as Bhita. This tradition was continued by Wheeler and those who followed him. Sadly, the full reports of some of these large excavations, like Wheeler's excavations at Mohenjo-daro for example, were never published in full, although in this case the pottery was published later by George Dales As a result much time and effort and much of the resources put into such an excavation are lost. However, in may cases certain important aspects of the work were published in the form of preliminary reports, articles in journals and conference volumes and so on. Our excavation in collaboration with Peshawar University at Charsada in 1963, is a case in point. A.H. Dani (1965-66) published a short preliminary report in *Ancient Pakistan*, including descriptions of some of the sculptures; and Raymond Allchin published papers on various objects of special interest, found in an early Kushana shrine house, including a unique cruciform reliquary casket (1972), a helmet of steel scale armour (1970), and complex evidence of the technique and practice of distillation (1979). The full excavation report was never published on account of a number of factors of the kind familiar to us all. But in spite of this here, as in many other cases, much unique material had been destroyed to no purpose, or in order to produce results that might have been achieved at much less cost in every sense. The same went for many smaller sites of all periods which were sometimes excavated almost in their totality, and much material was discarded which, today, would have provided valuable information on many aspects of the culture concerned and of its environment. Of course, this situation is by no means unique to India. It has occurred wherever there has been archaeological research. Moreover, in spite of the limitations we see today in the work of our predecessors, we must remember that it is upon this work that our understanding is founded, in every sense. By being positively critical and attempting to improve on what they did we can gain a great deal: but purely negative criticism on the other hand is purposeless.

The long term value of accurately recorded research has been demonstrated during the last twenty years by the work done at Mohenjo-daro by the German Archaeological Mission to Pakistan, using Marshall's records and material still available in various museums in India and Pakistan. The major part of the work was the relocation of many of the finds in the houses and rooms where they had been discovered. This has brought to light many interesting aspects of Indu's culture, such as plans of houses of various sizes, the uses to which rooms and buildings were put, and much more. All this will shortly be available on CD-ROM, and it is undoubtedly a powerful argument in favour of accurately recorded and fully published academic excavation.

As time has gone on large-scale excavation has become extremely expensive and consequently, the scale of all excavations has tended to be more modest. An excavation of any size has come to be seen as something that can only be undertaken in very special circumstances, where it can still play an important role in extending knowledge and understanding of the past, as for example at Dholavira or at Balathal. In many cases excavation of any sort is now seen as questionable because of its destructiveness and finality, and because archaeologists and others are becoming increasingly aware of the finite nature of all archaeological remains. This applies as much to rock-shelters and Palaeolithic working floors as to Chalcolithic cities and towns: there are only a limited number of any of them. As Mark Twain said about real estate "The thing about land is they've stopped making it", — and the same applies in a very real sense to archaeological sites. Obviously however there are numerous circumstances in which excavation is justified. From the academic point of view this could be said to be when, after intensive survey and careful study and consideration of all aspects of the situation, well planned and carefully targeted excavation is seen as the best way to answer specific problems and significantly extend knowledge.

New Approaches

Both prior to and during the last fifty years, the initial aim of understanding past cultures primarily through the study of their artefacts or material remains has undergone many changes. As the study of archaeology has developed, the aims and concepts on which research is based have become more complex and extended greatly in a number of directions. The process has engendered much discussion and some acrimony among archaeologists and prehistorians, and has spawned many theories and a good deal of curious jargon. Some aspects of archaeological thinking have grown towards and coalesced with developing ideas regarding heritage conservation; others towards environmental studies and the wider questions of climatic and environmental change. These developments can be seen as part and parcel of the worldwide change in attitude to the conservation of the environment and of the cultural heritage of mankind, — an attitude to which increasing reservation about excavation is closely related. This is something to which I shall return. Before doing so I should like to survey briefly some of the directions in which archaeological aims and scope have moved.

In practical terms, it seems to me, one of the first significant extensions of archaeological thinking and practice was the investigation of the subsistence basis of past cultures, achieved first of all by recovering organic remains from excavations by various techniques, and identifying them. This called for increasing care in excavating and accuracy in recording and studying the material. As time went on techniques were developed whereby much further information of many kinds could be obtained regarding how these resources had been used, and also understanding of changing human-animal and human-plant relationships, and the changes brought about in plants and animals by domestication. Both palaeobotany and palaeozoology have been developed with great success in India, as is demonstrated by the increasingly important part they play in excavation reports and archaeology generally. One related extension of archaeological aims is towards achieving an understanding of past environments; another is towards building up as complete a picture as possible of the geographical context of a settlement, a community or a group of settlements, and then trying to reconstruct as fully as possible their relationship to their environment as a whole. In these processes the identification of plant and animal remains plays a fundamental part, as do a number of branches of the Earth Sciences of which I shall have more to say later.

Physical Anthropology, as a means of knowing more about the people behind the cultures and, in the case of early prehistory, of studying the physical development of hominids and early humans, has become a close adjunct of both prehistory and archaeology. With the broadening scope of archaeological research in general it has been developed, refined and expanded to provide an understanding of the nature of past populations. Its offspring, palaeopathology, goes further, throwing light on the state of nutrition, diseases, injuries and seasonal and other stresses to which past communities were subject. It can bring a much sharper focus and more meaningful perspective to the picture we have of the kind of lives lead by individuals and communities and the pressures, hazards and even social constraints to which they were subject. Together these subjects demonstrate the relationship between lifestyle and physique in the case of individuals and populations.

Archaeological chemistry, often in combination with microscopy and other techniques, has become an extensive field in its own right, covering particularly the study and comparison of materials and their make up, with a view to understanding where and how they were made, and much more besides. It plays an important role in conservation, and also has been the means of unmasking a number of fake antiquities. Microscopy has also played an essential part in the study of the uses to which stone and other artefacts were put.

All these scientific techniques, or disciplines in their own right as they have become, which contribute to understanding various aspects of the human past, do so largely by examining in various special ways the physical and material remains of early human groups and societies. Most of the material they work on is obtained by excavation. All those so far mentioned have been successfully developed in India, chiefly but by no means exclusively at Deccan College under the direct influence or continuing inspiration of Professor Sankalia. As a result they have been developed in ways suited to the South Asian environment in terms of natural conditions, the nature of the archaeological problems being dealt with, and ongoing social and governmental situations. They been developed by a number of successful and innovative scholars too numerous to name here, but well known to most readers. Indeed, *Man and Environment*, not to mention a number of other journals both Indian and foreign contain a wide range of articles which amply demonstrate this.

Non-Digging Techniques

There is another whole range of techniques which can yield results without putting a spade into the ground, which have been largely developed in the West, and some of which have been used in India. These include first and foremost careful survey on the ground and recording of sites and antiquities. This can be aided and extended by a number of photographic processes, ranging from from aerial phototgraphy to satelite imagery which, when we have access to them, enable us to identify archaeological sites and other features, and monitor currently ongoing change in landscapes, monuments and areas of scientific interest generally; and also to understand both present-day and ancient landscapes, and the longer term changes that have taken place from the earliest prehistoric times forward. One of their important uses in South Asia is tracing ancient river courses which are of great significance in understanding the distribution of sites at different periods. All these sophisticated methods, however, are only of real archaeological value when they are combined with careful, painstaking survey and recording of sites on the ground by archaeologists sufficiently experienced to know what they are looking for and able to recognise both the expected and the unexpected when they see it. It seems to me that surveys of this kind are something for which there is a great need today not only in India, but throughout South Asia.

Such surveys, whenever they have been made, notably by Cunningham, Ferguson, Majumdar, Aurel Stein; more recently by J.P. Joshi and others in northwest India and by Rafique Mughal in the Pakistan Punjab; by Dilip Chakrabarti in eastern India; by Makkhan Lal and George Erdosy, in north India; and by many others, have proved immensely informative and become part of the basis of archaeological understanding in the Subcontinent. More detailed systems of survey which involve the precise mapping and recording of sites, their extent, grouping and relationship to one another and to major geographical features, especially rivers; and which take into consideration all observable evidence of the period or periods of occupation and other relevant factors observed, were employed by the last two researchers mentioned, with very rewarding results.

The precise mapping of objects and features on surface sites, and the observation of site formation processes of all kinds may be regarded as applications of a similar approach at a smaller scale. Only in the light of such information can the nature and importance of major sites be appreciated, and the cultural picture of a period understood The same applies to earlier prehistory, as the work of G.R. Sharma and others on the distribution routes of stone for tool making in the central Ganga valley and northern Vindhyas, and that of K. Paddayya and others on the Lower Palaeolithic of Karnataka clearly show. There is obviously great scope for further work of this kind, for which South Asia as a whole is uniquely suited because so many sites, and especially those of the Stone Age, are exposed on hard rocky surfaces.

Today surveys of all kinds have an additional importance for, in view of the rapid rate of destruction of known sites, it is clear that only if sites and monuments are put on record can any attempt be made to protect them, and then to decide which of them deserve preservation as representative parts of the national cultural heritage. Only then can effective steps be taken. If it is not possible to preserve a site or monument , or if it does not warrant preservation, it may be possible to carry out an excavation, or rescue dig, to obtain as much information as possible before it is destroyed. And if this is impossible or considered unnecessary, as complete a record as is required can be made.

Then there are the various methods of measuring electrical and magnetic resistance on the ground to what lies beneath between specified points, which do not appear to have been widely used in India or Pakistan as yet, but have been used with success in Britain and Europe, and by British archaeologists working in Sri Lanka. By these means it is possible to follow walls, ditches and other features such as the outlines of buildings, and to recognise areas of greater density such as streets and compacted floors.

The techniques mentioned above in brief outline are only some of those available to the archaeologist today, provided that he or she has access to them, fully understands how to use them, and has the necessary resources and contacts. They are all ultimately applications of physics, chemistry or biology.

Physics also contributes directly to archaeological research through the many methods of physical dating now available. Archaeologists of our generation all know very well how independent physical dating, beginning with ^{14}C, has transformed prehistoric and archaeological studies during out lifetime. Indeed the various methods of physical dating have probably done more to transform the subject than any other single factor. Used commonly today by archaeologists in combination with excavation, they are also widely used in many other situations, such as dating loess depoists by Thermoluminescence, for example, and dating rocks and sediments by Palaeomagnetism and other methods. They have brought to the study of early humans and hominids a structure based on dates which are accurate within certain calculated margins of error. Those methods that reach back into the more remote past are making possible a more generally accurate understanding of early hominid and human development throughout the world.

Ethnoarchaeology

Ethnoarchaeology, the study of existing traditional societies and traditional practices as a means of understanding and attempting to interpret the archaeological record — to put flesh on the dry bones of archaeological research — is another "non digging" approach. Unlike all the various techniques and approaches mentioned so far, its roots are not primarily in the sciences but in cultural anthropology and the social sciences. Therefore it provides a valuable counter balance to the numerous scientific disciplines and techniques now involved in archaeological research by emphasising the essential human, cultural aims of archaeology and prehistory which can all too easily be lost sight of in the pursuit of scientific data of all kinds. Obviously ethnoarchaeology has to be used by the archaeologist primarily as a tool for understanding material brought to light by more conventional archaeological methods, and in conjunction with other appropirate methods of investigation.

At present South Asia provides an exceptionally rich field for ethnoarchaeological research and therefore great potential for bringing a human dimension to South Asian prehistory to an extent that is not possible in much of the western world. Some very good work is being done on some of the many wonderful topics available: notably coastal archaeology and traditional boats and boat building, and their uses; and pottery making and the relationship of the craft to family and community life and tradition, and to distribution and marketing in changing conditions. In India it is still possible to observe these and a whole range of crafts and techniques which we know from the archaeological record have very ancient roots. They include stone and glass bead making, many kinds of metal working, stone image making, traditional decorating of houses, to mention only a few. We can observe them both, the technology and the social and economic relations of those engaged in the crafts, and those who sell, distribute and use the finished goods. The same applies to methods of building, house plans, the lay-out of settlements, and the relationships of communities within them as reflected in and demonstrated by these factors. Ethnoarchaeology has been used very effectively in interpreting the lay out and differing house types found in prehistoric settlements, as at Inamgaon. Much of what we observe today can be shown to have its origins in prehistoric times, or to have appeared at a particular point in time. Modern practice can illuminate archaeological findings, and conversely archaeology can demonstrate the antiquity and development through time of much traditional life and practice. If these things are understood the processes of change and development can be both more effective and less traumatic, and conservation of the cultural heritage much more genuine and acceptable both to local people and to tourists We and our successors will regret it greatly if we do not take advantage of this opportunity while we can.

What Now?

As a result of all these advances research in prehistory and archaeology has become a complex interdisciplinary matter, and the director of an archaeological research project these days sometimes feels him or herself to be a manager rather than a research worker. The days of the great archaeological supremo are over, and interdisciplinary collaboration is the order of the day. However, when it comes to the crunch, the ability to think clearly, to formulate the key questions and work out the best method of answering them in both academic and practical terms is still the essential function of the archaeologist, and must remain so if we are to succeed in extending our understanding of the past.

The archaeologist must often feel somewhat defeated by the choices that are available, in theory at any rate, regarding the methods to be used to deal with a particular problem, and also by the more general question of where the subject is going and what its place is in the modern world. As regards the first point one thing is certain: there is always more than one way of tackling an archaeological problem whether it is on the one hand a theoretical or academic problem formulated for research purposes, or on the other hand a practical problem that presents itself or is presented to one as part of one's work. But archaeology, like politics, is the art of the possible, therefore, while the most modern method is sometimes invaluable; at other times the traditional method is infinitely more suitable for all kinds of reasons. In any case one has to look at a problem in all its aspects very carefully, review the methods of tackling it actually and potentially available, and with the help of ones colleagues endeavour to come to the right decisions as to what is to be done. Then one has to locate the appropirate experts and establish a good working relationship and a mutually acceptable plan of action — this is where the managerial aspects of being an archaeologist become important! Happy the archaeologist who has colleagues at hand with the specialist knowledge and skills that are needed.

As regards the second point, where archaeological and prehistoric studies are going, it is clear that throughout the world the focus of archaeological investigation has chaged. Excavation which used to be regarded as the major research technique — sometimes indeed the only proper occupation for an archaeologist, is now one of a number of options, undertaken only after careful survey and evaluation of all the other possible methods of investigation. Excavation is both expensive and destructive, but sometimes it is the only course to follow. Survey of all kinds is much less expensive, although the cost of satellite imagery has increased sharply. It is also non-destructive, and tends to leave so much less follow up work to add to the future responsibilities and costs of the operation. Survey of all kinds, remote sensing techniques, and ethnoarchaeological studies can all be combined very satisfactorily with well chosen excavation on a manageable scale.

Academic and Applied Archaeology

We must pause briefly and consider what is now becoming quite an important practical distinction between two kinds of archaeological investigation, which we may call for the purpose of this discussion academic and applied archaeology. Academic archaeology consists in investigating problems primarily for the advancement of knowledge. In the countries of South Asia such research is normally sponsored by the ASI or its equivalent, or by a University or other institution, and carried out by officers of that institution. Additional outside sources are now beginning to be offered or sought. In addition some projects of this kind are carried out by foreign missions in all the countries of South Asia. In the West some research projects are sponsored by government institutions or Universities, but in many cases today those initiating a project are expected to raise a considerable part, if not all of the funding from outside sources. Other projects, like our Potwar Project in Pakistan, are initiated by scholars who raise all the funds from a range of sources, including government agencies and private foundations. This can be extremely hard work, and certainly tests every aspect of the organiser's management skills. In work of this kind one has to firmly maintain the archaeological aims as the central thrust of the project, while balancing the interest of other experts who are also doing exciting original research in their own fields as part of the project, and expect to publish both under their own names in journals and as part of joint publications of the whole project. As some of you here will know, this is not always easy.

Applied Archaeology

Frequently today excavation of all kinds is undertaken for practical reasons, as when a site is in imminent danger of inundation, as was the case at Nagarjunakonda, or of destruction due to industrial development, road building or similar causes. Sadly, throughtout South Asia opportunities of this kind are often lost, or only partly taken advantage of, due to lack of time, delay in making available the necessary resources, or pressure from vested interests. Examples being the Shahpur Tumulus recorded by Meadows Taylor in the mid-nineteenth century, which had disappeared when Leonard Munn searched for it early this century; and the rock art at the Neolithic site of Piklihal, recorded by us in the 1950s which has since been destroyed for use as road metal. There are thousands more examples. They include whole sites such as hills rich in rock art, fossil sand dunes on which prehistoric sties were located, extensive stone alignments, whole fields of Megalithic graves, occupation mounds of various periods, Stone Age procurement and factory sites which had remained virtually untouched since their users abandoned them, and many more, many of them recorded and published in past years by the ASI or its equivalent, or by others, which have completely disappeared. Obviously they could not and should not all have been preserved, but such wholesale destruction is a severe loss in terms of the cultural heritage of India, other South Asian countries and the world. Of course such situations are by no means unique to India or to South Asia: they are universal. They are however much more acute where population growth and development are rapid. The need for action is urgent.

Some Academic Problems for Future Consideration

Now I would like to look briefly at the future of research in some aspects of South Asian prehistory that are of particular interest to me. As I have already pointed out lack of evidence from cave deposits has tended at times to be seen as a stumbling block to understanding Palaeolithic cultures, and to an extent this is still the case. Now however, increasing understanding both of global patterns of climatic change and of plate tectonics, and the increasing potential for physical dating in geological as well archaeological situations, have put South Asia in an advantageous position. It seems to me that during the next few years there will be great opportunities for research in these fields if interdisciplinary collaboration is effective, and also provided that collaboration between scholars in India and Pakistan can be successfully maintained.

As it becomes possible to date tectonic events and their effects more accurately it will also be possible to relate them to past climatic phases with increasing precision. It should then be possible to relate early Stone Age cultures and hominid and human remains to the various changing environmental situations resulting from the combined effects of Himalayan uplift and world climatic change. Some of these situations are now emerging. Obviously times nearer to our own can be more accurately assessed. Therefore I shall briefly cite one or two examples of what I mean, starting from the mid-Holocene and then working backwards.

Many questions surround the long cultural build up to the Urban Indus Civilization, its development and obvious success, and its final collapse. Studies of world climatic change (e.g. Bryson and Swain 1981; Swain *et al.* 1983) confirm the earlier work of Gurdip Singh and others, and show that monsoon precipitation in the Indus region between c 3,000 and 1,500 B.C. (i.e. during the Urban period) was at least double that of the present. In addition they say that:—

> "The winter rains appear to have been at a maximum during Indus times, decreasing the winter desiccation that now characterises the region and increasing the overall precipitation efficiency".

These observations are obviously highly significant in themselves. The situation becomes more complex as one looks at some of the other aspects. A recent study of the Indus system (Flam 1993) indicates that during the period 4,000-2,000 B.C. the Lower Indus flowed through Sindh in a somewhat different course to that of today, known as the Sindhu Nadi. In northern Sindh it flowed to the west of the Rohri Hills, instead of through the Sukkur gap as it does today. Further down it flowed some distance to the southeast of its present course, passing some 25 km east of Mohenjo-daro. Today it flows so close to the site that, precautions have had to be taken to prevent its erosion. During this period the Hakra appears to have been an active river fed by the Saraswati and the Sutlej, both of which were later captured, the former by the Yamuna and the latter by the Indus. The drying up of the Saraswati appears to have been a progressive process the various stages of which can be dated by archaeological evidence from settlements along its course. The capture of the Sutlej by the Indus towards the end of the period must have considerably increased the flow of the Indus and may have contributed to its change of course which, in turn, deprived the city of much adjacent fertile, inundateable land upon which it must have depended to feed its citizens. It appears that the changes I have mentioned in the Sutlej, Saraswati, Hakra and Indus rivers were occasioned by morphological changes in the Himalayan valleys and/or the plains of the northern Punjab. Both kinds of change were due to Himalayan uplift caused by the ongoing collision of the Indian and Asian plates. All the changes in river patterns that I have outlined are clearly important factors both in the decline and abandonment of Mohenjo-daro and other cities of the Indus world, and in the rise of urban societies in the Ganga-Jamuna Doab from c. 1500 B.C. onward. When they are combined with the withdrawal of winter rains in Sindh and the general reduction in the monsoon briefly outlined in the previous paragraph, they must indicate a major environmental change throughout northwest India and much of Pakistan. These are all questions that deserve much more detailed investigation, of an interdisciplinary kind, in the field, the library and the laboratory, and could utilise the expertise of Indian, Pakistani and foreign teams.

Moving further back in time to the Last Glacial Maximum and the period of global warming that followed, for which a picture of the environment is beginning to emerge, I would like to draw attention to a situation that I feel also deserves investigation. Those of you who are familiar with the work of Louis Dupree, Richard Davies (1978) and others in Afghanistan will remember that in a number of caves both north and south of the Hindu Kush, Upper Palaeolithic artefacts were found along with animal bones, in some cases predominantly of sheep. This suggests that sheep were the preferred food animals of the makers of the Upper Palaeolithic tools, who may have domesticated them, or at any rate managed them and protected them from predators. Incidentally, in recent times the same caves have been used for herding sheep at night. This underlines the need for another excavation at Sangao cave in northwest Pakistan, mentioned earlier, which would give high priority to a study of the many bones and other organic materials the massive occupation deposit contains which have been not hitherto been studied. Moving to north India, it is interesting to note that in both the lower Son and Belan valleys sheep and goats, which are not considered to be indigenous to the region, make their first appearance in the fossil record in the gravels at the beginning of the third cycle of aggradation. These gravels have been dated by ^{14}C to between 19,000 and 22,00 years ago and to 10,000 years ago respectively, and they both contain Upper Palaeolithic blades, blade cores and artefacts which are not present in the earlier cycles. These dates fall within the latter part of the Last Glacial Maximum, when conditions in winter in the Himalayas must have been considerably colder than today; and cold and windy even in the northern Vindhyas and central Ganga plains. Both valleys would have provided welcome shelter. These facts have been noted by Gregory Possehl and others, and like the changing environmental conditions in the Indus Valley have been discussed by us in somewhat more detail in our recent book. I mention them here because they seem to me to be an example of the sort of problems that are now presenting themselves to South Asian prehistorians.

One of the most complex challenges is that of identifying the earliest Stone Age cultures in South Asia, and the hominids or early humans who made them. Our discovery in 1983 of artefacts in a gritstone conglomerate subsequently dated by palaeomagnetism to 1.9 myr, was initially greeted with considerable scepticism. Subsequent discoveries of artefacts, some accompanied by skeletal remains, of comparable antiquity in Southeast Asia and south China, Georgia and Israel have lead to a change in attitude and general acceptance. Our artefacts, which were somewhat rolled, were in material washed out of the Himalayas, deposited, and then refolded. They were exposed by recent down cutting of a small deep gully. The stratigraphy of such finds is highly complex, and it took all the skill of our geologist, Dr Helen Rendell to work it out, having previously completely revised the work of De Terra and

Paterson which had been done in the 1930s before the recognition of plate tectonics. Fortunately she had completed this before the find was made, and recognised its probable antiquity. The Siwalik stratigraphy is bound to be complex by its nature. For this reason, and because of the terrain, searching for further early material is going to be hard work and, as with so many things of this kind, there is always an element of luck involved. However, I consider that there may well be further evidence of early Hominid presence in the Indian Siwaliks. In this connection, I very much hope that I shall be able to see the material found in this area by Dr. Verma in the 1970s, which I believe is in the Wadia Institute at Dehra Dun.

Where pre-handaxe material might be expected in peninsular India is, as they say, another ball game. The effects of plate tectonics in the region are beginning to be understood, and this and other aspects of the geology of Quaternary and pre-Quaternary times need to be investigated further, I feel, in order to know where to search, and to recognise early contexts. There is a tendency to assume that there is no pre-handaxe material in peninsular India, but I think that, in view of the way early hominid remains having been coming to light in Asia in recent years, this is a dangerous assumption, and we should go on trying.

Conclusion

I have already summarised what seem to me to be three areas for future research on the prehistory of India and South Asia as a whole, which all involve matters of world interest, and within each of which a number of interesting problems can be formulated which deserve further investigation on a fairly broad interdisciplinary basis, and I shall not say any more about this.

Regarding the practical applications of prehistory and indeed of archaeology generally in India today and in the future, all I can say is that there is clearly a tremendous need for constructive thinking among Indian prehistorians, archaeologists, historians and others about this. I hope that you will be able to find ways to bring the great fund of expertise that exists in this Society and in this country to bear on questions of enlightened and selective conservation of India's immense and wonderful cultural heritage. This is urgent. It cannot be put off until next year, or even next month. You, as a National Society, and as a body of present and future authorities on large parts of that cultural heritage are in a position to do something about this if anyone is.

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Full bibliographical references to all work referred to in this paper would constitute a voluminous bibliography occupying many pages. As virtually all the books and papers this would include will be familiar to readers of *Man and Environment* this seems to be unnecessary, and therefore only certain key references to research papers not readily available in India have been included here.

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Rediscovering the Janapada Punch-Marked Coins of Early Historic India*

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Abstract

This is the first time that an extensive classification has been carried out for the lesser known Janapada Punch-marked coins of Pre-Mauryan India. This preliminary paper is based on extensive fieldwork carried out from 1992 to 1994 throughout the country, during the course of which nearly 10,000 Punch-marked coins were photographed and studied. Apart from this, thirty published coin hoards and thirty-odd unpublished coin hoards were also studied. All these data were finally classified and the coin series attributed to their respective Janapadas.

Introduction

In prehistoric times, mankind seemed to have learnt value first, weight next, and then during historic times, he learnt to stamp the metallic pieces. In other words, barter developed into currency, currency into money, and money into coinage. Similarly, it can be said that money included any medium of exchange used for transactions, e.g. cattle, stones, metal pieces, etc., whereas a coin can be defined as a piece of metal having a definite weight and size, struck by a legal authority with design and/or inscription, and current as money. The advent of coins provides substantial and significant documentation of a well established urban civilization as a part of the second urbanization in about the first millennium B.C. Since then coins have acted as time-capsules recording the economic, socio-cultural and political conditions prevalent in their times.

The earliest coins found within the Indian subcontinent are popularly known as Punch-marked coins. These coins, dated as early as the sixth-seventh centuries before Christ, were issued by various states called *Janapada*. The term Punch-marked is a recent name given to the silver currency which was manufactured by the Punch-marked technique. These coins are one of the most abundant coinages of Asia struck in the pre-Christian era. Unlike contemporary coinages of the West, the Punch-marked coins were issued with various symbols ranging from one through five. All these symbols were punched in a definite order which represented the issuing authority, the mint and the mint-master. Unfortunately, the decoding of such symbols is as mysterious as the Harappan script. Interestingly, a story in the *Vissudhimagga* (Bhandarkar 1921) of Buddhaghosha, dating back to the fifth century A.D. shed some important light in this direction. In the said Pali work, Buddhaghosha describes how a lot of coins lying on a wooden slab would strike an inexperienced boy, a man from village, and a *shroff* or a money-lender. The boy would notice simply that some coins were oblong, some round, and some elongated in shape. The rustic would know all this, and also that coins were, like gems, worthy objects of enjoyment to mankind. The *shroff*, on the other hand, would not only be conversant with all these, but would also be in a position to decide, after handling the coins in a variety of ways, which of them was struck at which village, mofassil town, capital city, mountain and river bank, and also by which mint-master. However, in the absence of any positive evidence revealing the true nature of these symbols or pictographs on the Punch-marked coins, it is not possible to forward a concrete theory of their identification and attribution, however, a few generalizations have been suggested here.

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* Paper selected for the Professor H D Sankalia Young Archaeologist Award 1997

The Punch-marked coins of ancient India can be divided into three principal groups:

i) Janapada or Pre-Mauryan coins,

ii) Imperial or Magadha-Maurya coins, and

iii) Provincial or Post-Mauryan coins.

As far as the Imperial and Provincial coins are concerned, a basic classification has already been done by scholars like Mitchiner (1973, 1975, 1978), and Gupta and Hardaker (1985). What is missing is a basic framework for the *Janapada* or the Pre-Mauryan coins of Early Historic India. The present paper deals with this neglected aspect of Indian numismatics.

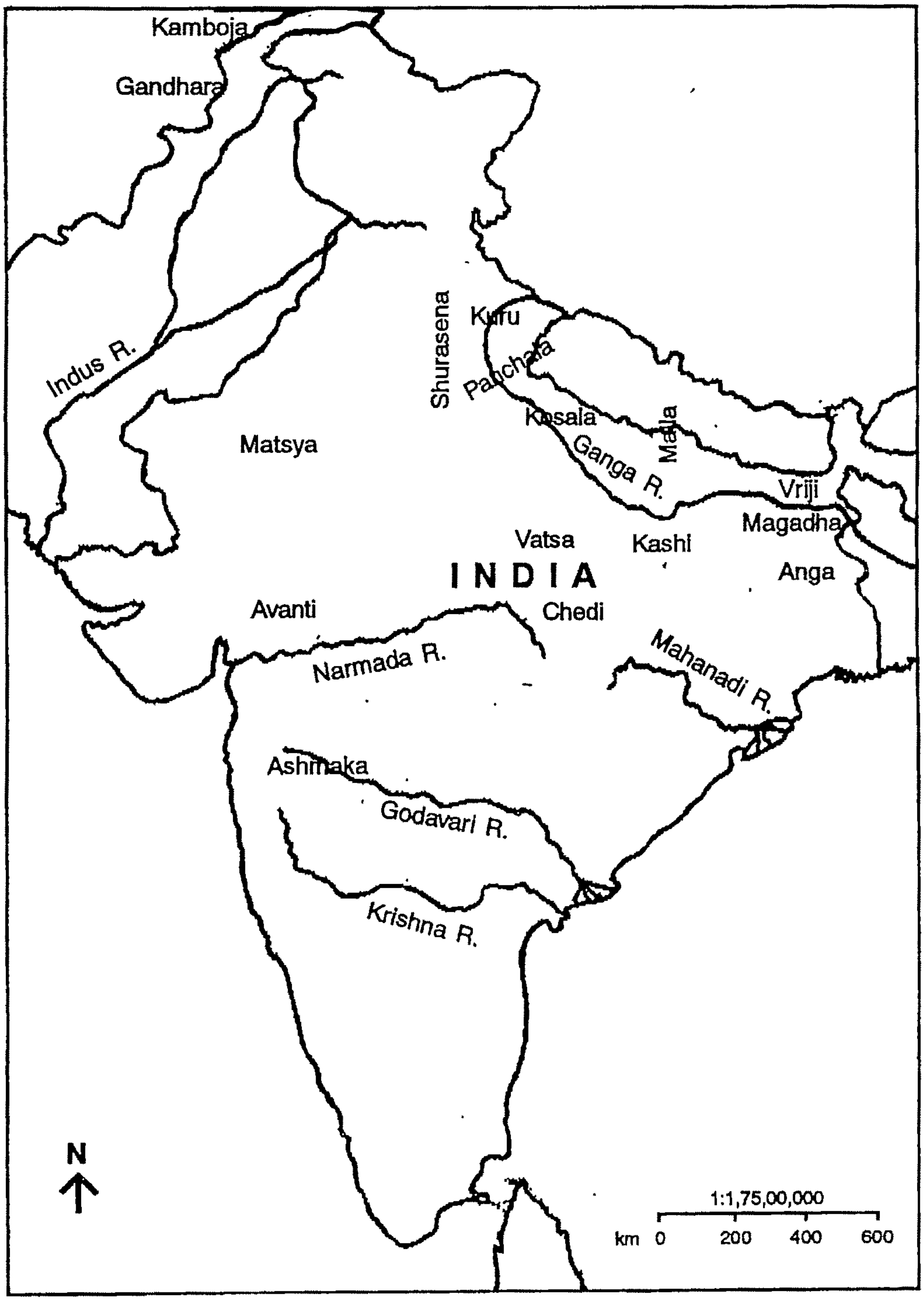
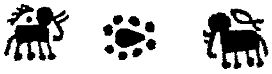
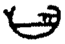
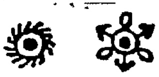
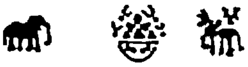
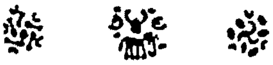
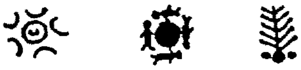
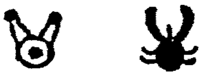


Fig. 1: The sixteen Mahajanapadas of Buddhist India

Table 1: State symbols of the Janapadas

State Symbols	**Janapada**
	Āndhra
	Vaṅga
	Magadha
	Surāshtra
	Avanti
	Ashmaka
	Kuntala
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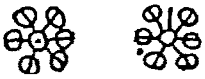
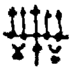
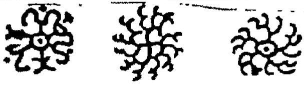
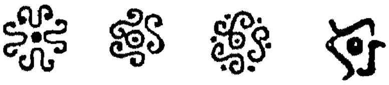
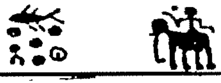
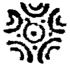
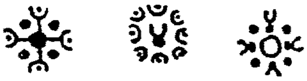
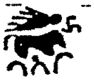
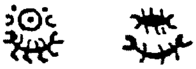
	Gandhāra
	Kaliṅga
	Kāshi
	Kosala
	Kuru
	Malla
	Pañchāla
	Shurasena
	Vatsa

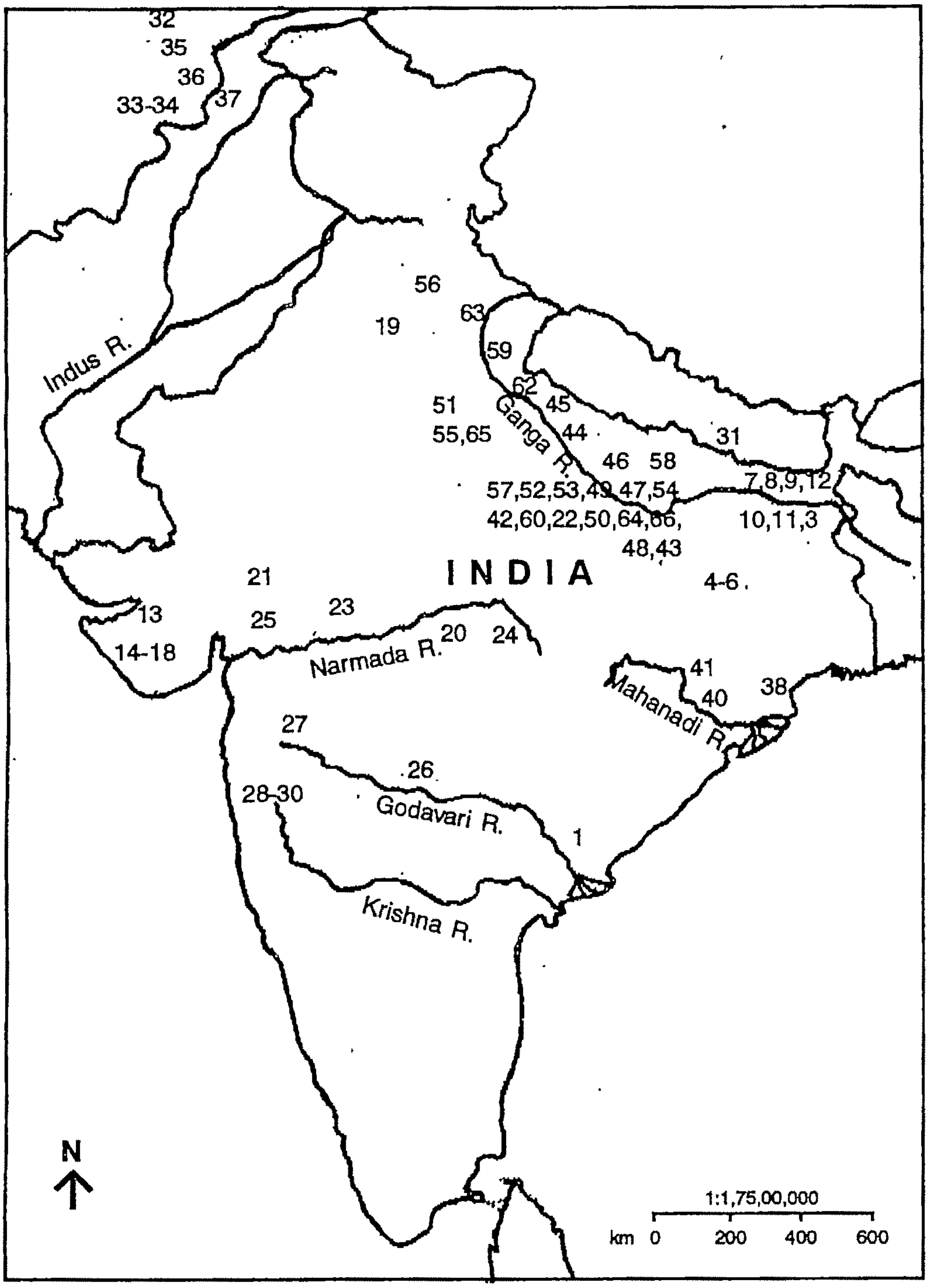


Fig. 2: Distribution of Janapada coin hoards (see Table 2 for hoard names)

Janapada Coins

Janapada is a kind of political state. It is derived from the words *Jana* (people) and *pada* (home) meaning thereby "the abode/home of the people/tribe". In the Puranas (Agrawala 1953b) one hundred and seventy-five names of different Janapadas are preserved. In the Buddhist chronicle, *Anguttara Nikaya* mention has been made of seventeen Mahajanapadas or large States during the time of the Buddha. These were: Kashi, Kosala, Anga, Magadha, Vriji, Malla, Chedi, Vatsa, Kuru, Panchala, Matsya, Shurasena, Ashmaka, Avanti, Gandhara and Kamboja (Fig. 1).

The coins collected during the author's fieldwork were classified and attributed to their respective issuing

Janapadas. The resulting classification into 82 distinct types were then classified further. On the basis of the provenance of coin hoards and the location of ancient Janapadas, the coin series have been assigned to 17 Janapadas.

Orientation

The orientation of all the Janapada Punch-marked coins included one or more of the categories of coins having one or up to five symbols.

Apart from the orientation, each Janapada had distinguishing symbols which were common to all the coins found in that region (Table 1). This also corroborates the attribution. The following seventeen Janapadas — Andhra, Vanga, Magadha, Surashtra, Ashmaka, Kuntala, Shakya, Gandhara, Kalinga, Kashi, Kosala, Kuru, Malla, Panchala, Shurasena, and Vatsa (Fig. 3) — issued their

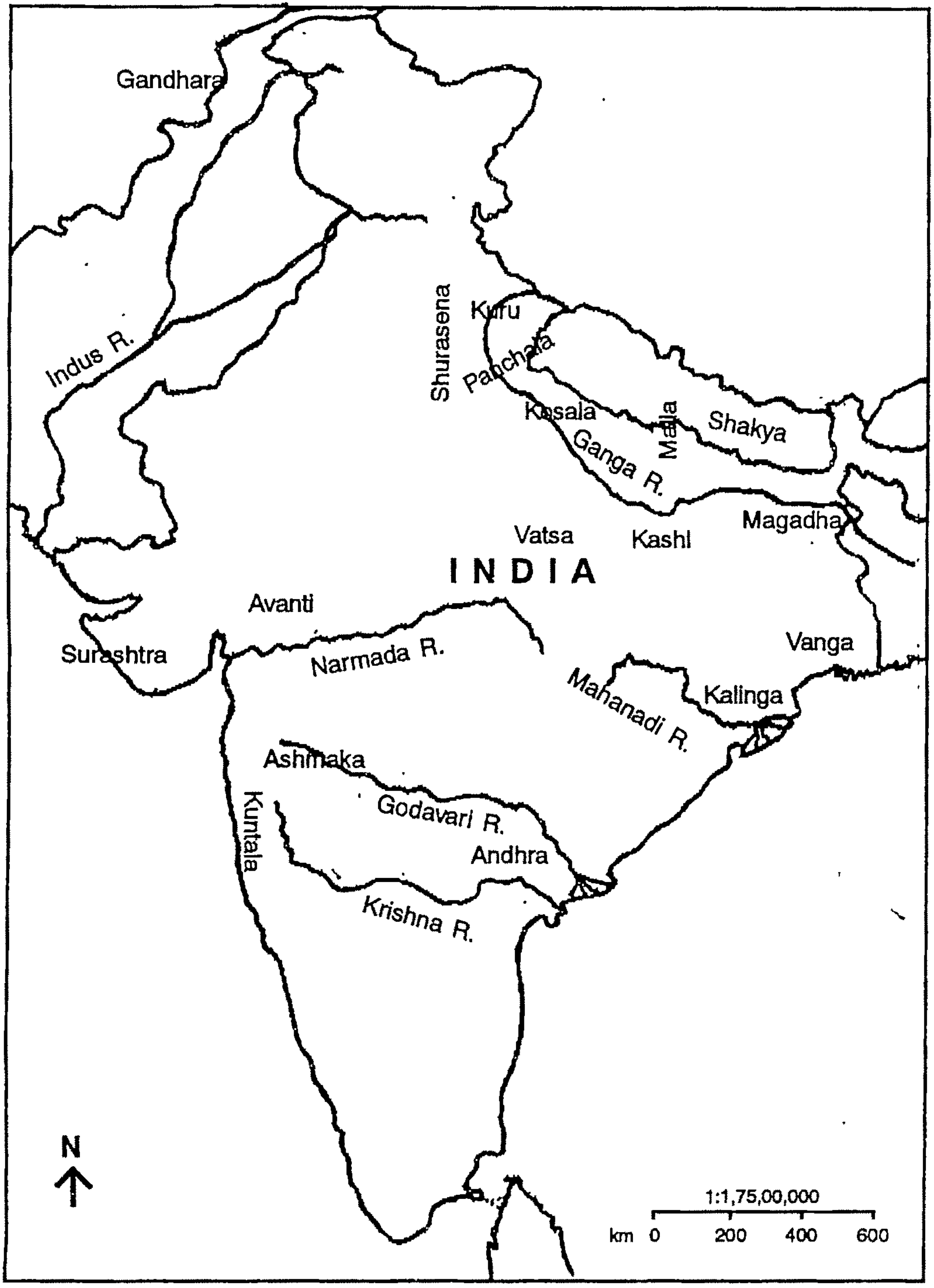


Fig. 3: The Janapadas to which the various Punch-marked coins are assigned

Table 2: Concordance of coin hoards (to be located on Fig. 2)

Hoard No.	Name	Find-spot	State	Details	Reference
1	Shingavaram Hoard	Shingavaram, District Krishna	Andhra Pradesh	1934; Silver 60,000 coins (about 100 kg)	Aravamuthan 1936; Agrawala 1952
2	Manipur Hoard	Exact find-spot not known but certainly not from Manipur	Bengal	1971; Silver 60 coins	Valdettaro 1978
3	Baxur Hoard	Baxur, District Bhojpur	Bihar	1953; Silver 20 coins	Unpublished
4	Bhabua Hoard 1953	Bhabua, District Rohtas	Bihar	1953; Silver 90 coins	Unpublished
5	Bhabua Hoard 1981	--do--	Bihar	1981; Silver 450+ coins (about 2.5 kg)	Cribb 1985a
6	Bhabua Hoard 1991	--do--	Bihar	1991; Silver 90 coins	Unpublished
7	Golakhpur Hoard	Golakhpur, Patna city	Bihar	1918; Silver 108 coins	Walsh 1939 Prasad 1934
8	Katra Hoard	Katra, District Muzaffarpur	Bihar	before 1993: Silver, 86 coins	Kothari 1993
9	Machhua Toli Hoard	Machhua Toli, Patna city	Bihar	1937; Silver 2232 coins	——
10	Magadha Hoard 1973	Somewhere in Bihar	Bihar	1973; Silver 44+ coins	——
11	Magadha Hoard 1976	--do--	Bihar	1976; Silver 75 Coins	——

Hoard No.	Name	Find-spot	State	Details	Reference
12	Ramna Hoard	Ramna, Patna City	Bihar	1935; Silver 45 coins	——
13	Dhank Hoard	Dhank, District Rajkot	Gujarat	1873-74; Silver 56 coins	Codrington 1876: Rajgor 1994, 1996
14	Girnar Hoard	Girnar, District Junagadh	Gujarat	1990; Silver 50+ coins	Rajgor 1994, 1996
15	Junagadh Hoard 1985	District Junagadh	Gujarat	1985; Silver 100+ coins	Rajgor 1994, 1996
16	Junagadh Hoard 1991	--do--	Gujarat	1991; Silver 265 coins	Rajgor 1994, 1996
17	Junagadh Hoard 1991a	Outskirts of Junagadh city	Gujarat	1991; Silver 4000+ coins	Rajgor 1994, 1996
18	Sherdi Hoard	Kantharlo Timbo, Sherdi, District Junagadh	Gujarat	1964; Silver 400+ coins	Rajgor 1991, 1994, 1996
19	Babyal Hoard	Babyal, Near Rohtak	Haryana	1992: Silver 500+ coins	Unpublished
20	Dhapewar Hoard	Dhapewar, District Balaghat	Madhya Pradesh	1893; Silver 92 coins	Gupta 1957
21	Malwa Hoard	Somewhere in Malwa	Madhya Pradesh	1991-92; Silver 17+ coins	Unpublished
22	Mamdar Hoard	Mamdar, District Sidhi	Madhya Pradesh	before 1959; Silver 54 + 13 Coins	Kothari 1992; Unpublished

Hoard No.	Name	Find-spot	State	Details	Reference
23	Nagda Hoard	Nagda, District Dewas	Madhya Pradesh	1974-75; Silver 50 coins	———
24	Tarapur Finds	Tarapur, District Raigadh	Madhya Pradesh	1927; Silver 15 coins	Gupta 1957
25	Ujjain Hoard	Ujjain	Madhya Pradesh	1981; Silver 7+ coins	———
26	Nanded Hoard	Nanded, District Nanded	Maharashtra	1985-86; Silver 1 kg coins	Patil 1991
27	Nasik Hoard	District Nasik	Maharashtra	1977-78; Silver 25+ coins	Maheshwari 1978, 1982
28	Sultanpur Hoard 1876	Sultanpur, District Satara	Maharashtra	1876; Silver 52+ coins	Codrington 1876
29	Sultanpur Hoard 1960	---do---	Maharashtra	1960; Silver 2 pounds of coins	Gupta 1965
30	Sultanpur Hoard 1991	---do---	Maharashtra	1991: Silver 120+ coins	Unpublished
31	Lumbini Hoard	Rummin Dei, District Bhairhwa,	Nepal	1985; Silver 900+ coins	Unpublished
32	Bajaur Hoard	Bajaur	Pakistan	1942; Silver 700 coins	———
33	Bhir Mound Hoard 1924	Bhir Mound, Taxila	Pakistan	1924; Silver 1167 coins	Walsh 1939a

Hoard No.	Name	Find-spot	State	Details	Reference
34	Bhir Mound Hoard 1945	Bhir Mound, Taxila	Pakistan	1945; Silver 18 coins	Young 1946
35	Chaman Huzuri Hoard	Chaman Huzuri, Kabul	Afghanistan	1933; Silver 127 coins	Curiel 1953
36	Mir Zakah Hoard	Mir Zakah, Gardez	Afghanistan	1948; Silver 13,083 coins	Curiel 1953
37	Peshawar Hoard	Peshawar	Pakistan	1991; Silver 500 coins	Unpublished
38	Balapur Finds	Balapur, District Sambhalpur	Orissa	before 1948; Silver 7 coins	Gupta 1957
39	Prasad Hoard	Find-spot not known		before 1936; Silver 97+ coins	Unpublished
40	Sambhalpur Hoard	Sambhalpur	Orissa	1948; Silver 2 coins	Gupta 1957
41	Sonepur Hoard	Sonepur, District Balagir	Orissa	before 1951; Silver 162 coins	Gupta 1957
42	Allahabad Hoard	District Allahabad	Uttar Pradesh	before 1981; Silver 120 coins	Kothari 1992
43	Aurihar Hoard	Aurihar, District Ghazipur	Uttar Pradesh	1952; Silver 534 coins	Unpublished
44	Ayodhya Hoard	Ayodhya, District Faizabad	Uttar Pradesh	1930s; Silver 50 Coins	Unpublished

Hoard No.	Name	Find-spot	State	Details	Reference
45	Bhinga Hoard	Bhinga, District Bahraich	Uttar Pradesh	1887; Silver 10 coins	Shrivastava 1980
46	Gorakhpur Hoard	District Gorakhpur	Uttar Pradesh	1987-88; Silver 175 coins	Unpublished
47	Jais Hoard	Jais, District Rai Bareli	Uttar Pradesh	1990-91; Silver 100+ coins	Unpublished
48	Jakhania Hoard	Jakhania, District Ghazipur	Uttar Pradesh	1991; Silver 2500 coins	Unpublished
49	Kanpur Hoard	District Kanpur	Uttar Pradesh	1991-92; Silver 20+ coins	Unpublished
50	Kosam Hoard	Kaushambi, District Allahabad	Uttar Pradesh	1937-38; 569 coins	Dasgupta 1950
51	Kosi Kalan Hoard	Kosi Kalan, District Mathura	Uttar Pradesh	1985; Silver 4700 coins	Unpublished
52	Lotapur Hoard	Lotapur, District Unnao	Uttar Pradesh	1928: Silver 1411 coins	Prasad 1934,1936; Unpublished
53	Lucknow Hoard	District Lucknow	Uttar Pradesh	1930s; Silver 700+ coins	Gupta 1962
54	Marjadpur Hoard	Marjadpur, District Banda	Uttar Pradesh	1897; Silver 341 coins	Unpublished
55	Mathura Hoard	District Mathura	Uttar Pradesh	1992; Silver 300+ Coins	Unpublished

Hoard No.	Name	Find-spot	State	Details	Reference
56	Muzaffarnagar Hoard	District Muzaffarnagar	Uttar Pradesh	1990-91; Silver 100+ coins	Unpublished
57	Nandagaon Hoard	Nandagaon, District Mathura	Uttar Pradesh	1990-91; Silver 8800 coins	Unpublished
58	Narhan Hoard	Narhan, District Gorakhpur	Uttar Pradesh	1985; Silver 50 coins	Singh 1994
59	Palia Hoard	Palia,District Kheri	Uttar Pradesh	1912; Silver 1245 coins	Walsh 1940
60	Ramnagar Hoard	Ramnagar, District Jaunpur	Uttar Pradesh	1940; Silver 104+ coins	Shrivastava 1980
61	Repoussé Hoard	Not known	Uttar Pradesh	before 1955; Silver 215+ grams	Unpublished
62	Sahet-Mahet Hoard	Sahet-Mahet, District Bahraich	Uttar Pradesh	1935-36; Silver 500 coins	Prasad 1934; Unpublished
63	Shamiawala Hoard	Shamiawala, District Bijnor	Uttar Pradesh	1920: Silver 143 coins	Prasad 1939
64	Shirsa Hoard	Shirsa, District Allahabad	Uttar Pradesh	?; Silver 800 coins	Unpublished
65	Sonkh Hoard	Sonkh, District Mathura	Uttar Pradesh	before 1980; Silver 12+ coins	Gupta 1989
66	Varanasi Hoard	District Varanasi	Uttar Pradesh	1981; Silver 4+ Coins	—

coins from about the 6th century B.C. to the rise of the Mauryas.

Dating

In the absence of inscriptions on the Punch-marked coins, their dating has remained an enigma. Among scholars, two schools have surfaced. The first consists mainly of oriental scholars (Agrawala 1953a) who date these coins to as early as the eighth century B.C. whereas the second (Cribb 1983, 1985a,b, 1995, 1996) mostly comprising occidental scholars attribute the issue of Punch-marked coins to as late as the fourth century B.C.

Interestingly, a third school came into existence with a new theory which proposed that the uninscribed copper cast coins which are normally attributed to the third century B.C. were in circulation between 885-605 B.C. thereby hypothesising that the Punch-marked coins were a later introduction. This theory is based on the excavation carried out by Sharma (1960) at Kaushambi. It is argued in this connection that the site's second cultural periods, datable to 885-605 B.C., are the context of the appearance and circulation of coins. However, Chakrabarty (Cribb 1996) rightly comments that "... Sharma's chronology for the first two periods leaves one baffled. The method by which he estimates their dates (assigning an average span of 75 years to all sub-periods including the earlier ones)..." not a very dependable one. He further suggests that the second period and its associated pottery would be better dated on the basis of the third-second century coin excavated from it.

At present the first two schools are part of an international debate (Atkins 1995; Cribb 1995a, b, 1996; Page 1996; and Pieper 1996). However, based on the data it can be hypothesised that stamped currency in India was already in vogue in the Ganga region in the sixth century B.C.

Classification

1. *Andhra Janapada c. 500-350 B.C.*

Silver coins of the Andhra Janapada weigh between 1.5 to 1.8 g, corresponding to the weight of 1/2 Karshapana. The size of these coins varies between 14 to 17 x 28 mm. The uniface coins of this Janapada display four symbols having one pair of symbols with two different symbols. The only recurring symbol in the series is an elephant with minor variations. The second mark is variable, while the third and the fourth symbols form a pair of one and the same mark struck from a single die. Fractions are also known, viz., 1/4 Karshapana and Mashaka. Coins of the former are similar to those of the 1/2 Karshapana series whereas Mashaka coins are repoussé with a single symbol (Aravamuthan 1936; Agrawal 1952).

2. *Vanga Janapada c. 550-500 B.C.*

Coins of the Vanga Janapada are known from Bengal and are reported in three denominations. Karshapana coins are of debased silver, sometimes referred to as of billon. Their weights range from 2.8 to 3.5 g. The orientation of these include three different symbols punched separately. 1/2 Karshapana coins are of silver and are known from the so-called Manipur hoard. These weigh between 1.7 to 1.95 g, and contain four different symbols with the sun and six-armed symbols being constant. Pada Karshapana or ¼ coins are of silver, and display four different symbols with the sun as the first constant symbol (Valdettaro 1978; Chaudhury 1962).

3. *Magadha Janapada c. 600-410 B.C.*

The earliest coins of the Magadha Janapada had only one large central mark known as the six-armed symbol. These coins weigh around 5.3 to 5.8 g. Later a small sun mark was added to the first symbol. These coins have weights ranging from 5.2 to 6.0 g. Vimshatika coins of 4.6 to 5.5 g had four symbols, the first two being the sun and the six-armed symbol (Fig. 4). Similar coins were issued in the Karshapana standard of about 3.5 g each.

The monetary reforms in the Magadha Janapada still continued and this time the Karshapana coins were issued with five different symbols (Fig. 4). The first two symbols

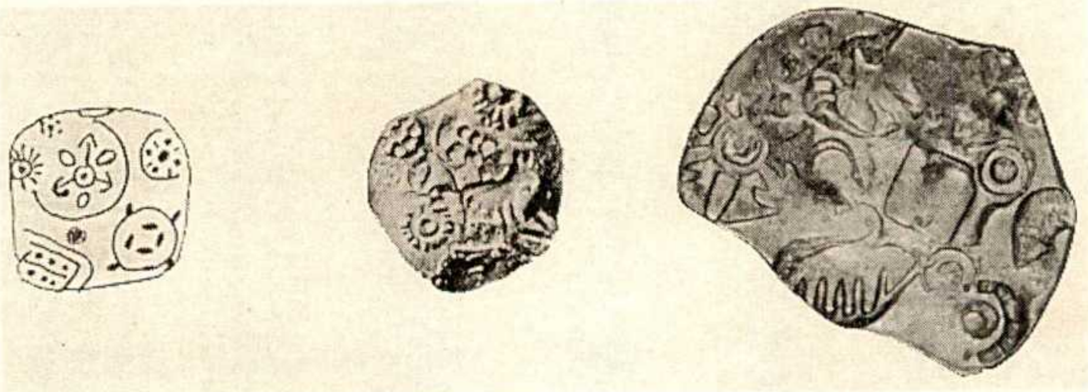


Fig. 4: Magadha coins

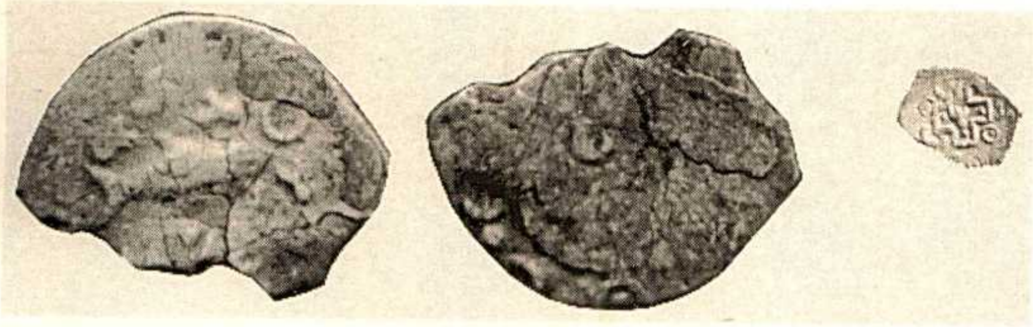


Fig. 5: Surashtra coins

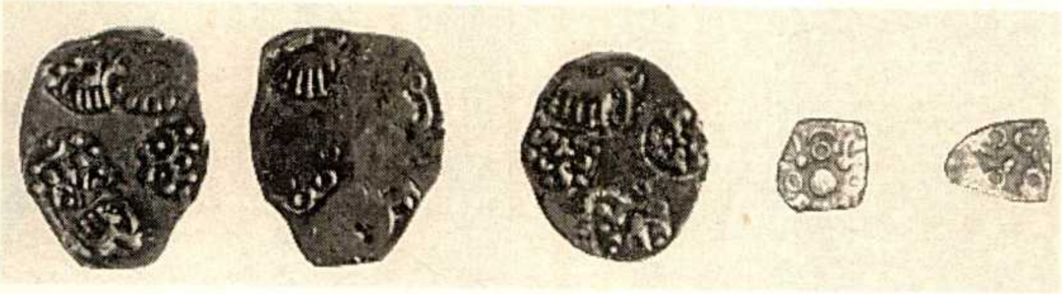


Fig. 6: Avanti coins

were invariably the sun and the six-armed symbol; the third and the fourth remained constant and the fifth changed or the third was constant and other two changed or the first two remained unaltered and the remaining three varied (Gupta and Hardaker 1985).

Surashtra Janapada c. 450-300 B.C.

Coins of this Janapada are chiefly known from the Junagadh district of Saurashtra in Gujarat. These silver coins are small square pieces of about one gram each. The most important feature of these coins is that they are produced by the single-die technique. Often existing coins of the same Janapada were called back by the mint authorities and were reused by stamping them with new marks on the other side of the unifaced coins (Fig. 5) At times, coins were also cut into halves and quarters to serve as fractions (Fig. 5). Furthermore, Karshapana coins of the Magadha Janapada were restamped after clipping them to the required standard weight (Rajgor 1994, 1996).

Avanti Janapada c. 500-400 B.C.

Avanti coins are known in four denominations, viz., Karshapana, 1/2 and 1/4 Karshapana and 2 Mashaka. The Karshapana coins were of silver — about 3.6 g each (Fig. 6). Unifaced coins of this denomination display four punches having three symbols: one symbol being punched twice. The first mark seems to be constant representing variations on the elephant symbol. The second varies in execution whereas the other two form a pair from the same punch.

1/2 and 1/4 Karshapana and 2 Mashaka coins are single symbol coins with weights ranging from 1.3 to 1.7 g; 0.8 to 1.0 g and 0.4 g respectively. These coins display a large central symbol (Fig. 6).

Ashmaka Janapada c. 500-350 BC.

Silver coins of the Ashmakas weigh between 1.3 to 1.7 g, corresponding to 1/2 Karshapanas. These coins have four symbols: an elephant, a tree, the third and the fourth forming a pair stamped from a single punch (Fig. 7). Halves of this type are also reported.

Kuntala Janapada c. 600-450 B.C.

Kuntala coins are known in silver as well as in copper. Silver pieces are dumpy with a central impression (Fig. 8). Weight varies between 6.3 to 7.5 g. Halves have a weight

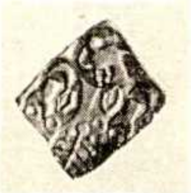


Fig. 7: Ashmaka coin

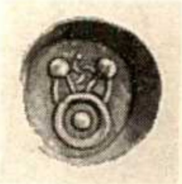


Fig. 8: Kuntala coin

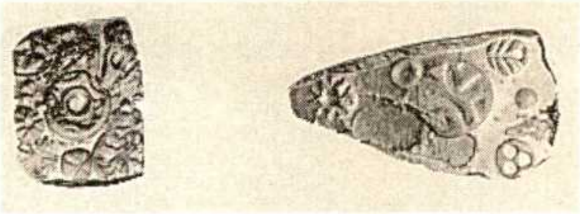


Fig. 9: Shakya coins

range of 3.2 to 4.7 g and the quarters vary between 1.5 to 1.9 g. A single copper coin was found with a punch mark of two similar symbols, and weighing 5.1 g (Smith 1906: PL. xix-9).

Shakya Janapada c. 600-500 B.C.

Silver coins of the Shakya Janapada are chiefly known from an unpublished hoard reported from Lumbini in Nepal. These bar-type coins are heavily struck in the centre with a punch having a single symbol (Fig. 9). The weight of these coins ranges from 7.0 to 7.2 g (McIntyre 1991).

Gandhara Janapada c. 600-300 B.C.

Gandhara coins can be classified into three distinct categories, viz., bent-bar type coins, single-symbol coins, and coins with animal motifs.

Bent-bar coins (Fig. 10) are long bar type coins with two symbols punched on both the ends from a single punch. These coins are of three types. The earliest bent-bars are quite long and of good silver. At times these coins were as long as 57 mm. The second phase was of medium sized coins with reduced sizes ranging between 13x24 to 13x32 mm. The metal of these bars was debased. The third and the last phase comprised short bars with the size reduced to 14x25 mm. The weight of these coins was also reduced from 11.3 g to 7.3 g and their metal contents reduced from silver plated copper to pure copper.

Coins with a single symbol are scyphate coins with a central symbol. Four weight standards are known in this category, i.e., 4.1 to 5.0 g, 2.2 to 2.8 g, 1.1 to 1.4 g, and 0.49 g. Coins with animal motifs are struck on both sides: one carrying a wheel-like symbol of the bent-bars crudely executed, whereas the other shows a crude animal figure or a geometrical design. These coins occur in the following weight groups: 9.05 to 11.65 g, 4.4 to 6.0 g, and 2.1 to 2.8 g (Curiel and Schlumberger 1953).

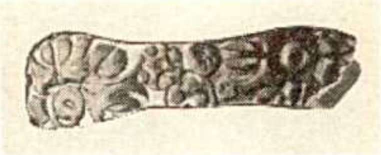


Fig. 10: Gandhara coin

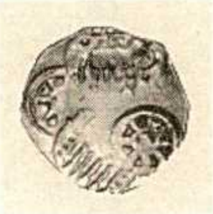


Fig. 11: Kalinga coin

Kalinga Janapada c. 500-260 B.C.

Silver coins of the Kalingas are 1/2 Karshapana coins weighing from 1.7 to 1.85 g each. The sizes vary between 17x18 to 22x27 mm. Unifaced coins of this Janapada exhibit four symbols on one side comprising two representations of one symbol, and two different symbols (Fig. 11).

Kashi Janapada c. 600-465 B.C.

Coins of the Kashi Janapada seem to be one of the earliest coin issues in Indian history. They can be classified into two groups: coins issued before the seizure of Kashi and those issued after it.

Kashi is said to have been conquered by Kamsa, the ruler of Kosala who was later known as *Baranasiggaho*, i.e., the conqueror of Baranasi. Coins issued before this conquest (c. 600-525 B.C.) form the first group, and are of two types: the Bhabua type and the scyphate type.

Bhabua coins are chiefly known from Bhabua in Bihar. These are large and thick issues compared with the scyphate coins. Their weight varies between 5.1 to 6.4 g, and their sizes range from 19x23 to 24x33 mm. The orientation of these coins include a pair of one symbol and two different symbols. Invariably, all the Bhabua coins have two large punches of two different symbols, and two smaller punches of a single symbol. Fractions of this type are reported with a single punch or two punches. The weights of the fractions are 3.2, 2.1, 1.1 and 0.3 g.

Scyphate coins (Fig. 12) are also of silver with the standard weight of Vimshatika (4.4 to 5.2 g). The orientation is quite simple. Normally, two pairs of two symbols are punched, one opposite the other. At times, instead of two pairs, one pair of one symbol and two different symbols are also encountered. Halves of these are reported with a single central punch.

Silver coins of the second group (after the conquest of Kashi by Kosala), are later issues (c. 525-465 B.C.). These Vimshatika coins are smaller and thicker than the scyphate coins. They weigh between 4.5 to 5.0 g and vary in size from 16 x 28 to 27 x 29 mm. Their orientation includes

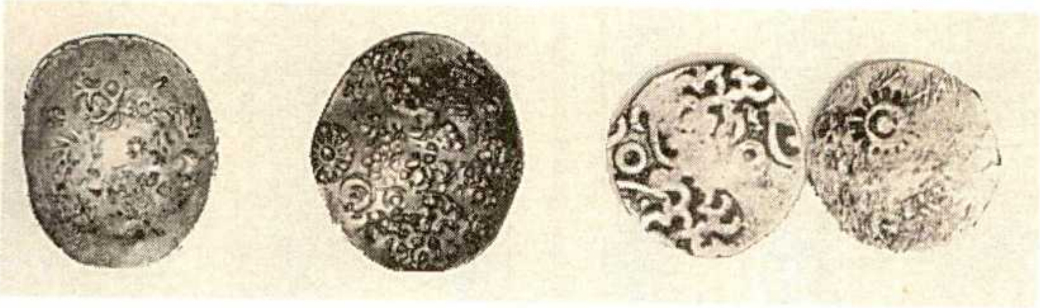


Fig. 12: Kashi coins

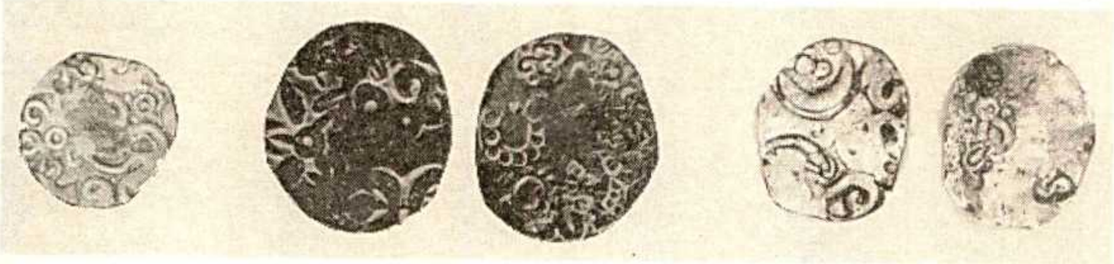


Fig. 13: Kosala coins

either two pairs of two symbols or one pair of one symbol and two different marks (Fig. 12).

Interestingly, the weight standard of the Vimshatika coins was changed at a later date to the Karshapana standard of 32 *rattis*, equivalent to 3.5 g. These coins were issued on very thin sheets of silver. The size of the flans, at times, was as large as 26 x 29 mm.

Kosala Janapada c. 525-465 B.C.

Silver coins of the Kosala *Janapada* were also issued in two different weight standards, viz. Vimshatika and Karshapana. Coins of the former are small dumpy pieces with four symbols. The orientation consists of a pair of one symbol and two different symbols (Fig. 13). Halves of these pieces — segments of full units — have been reported.

Coins of the Karshapana standard are of about 3.3 g, and vary in size from 12 x 15 to 27 x 31 mm. These coins display either a pair of one symbol and two different symbols or four different symbols (Fig.13). Surprisingly, the weight of these coins was found to have been reduced to as little as 2.3 g. The orientation of these coins displays four different symbols (Fig. 13). Halves and quarters of full units are also reported with a single central symbol.

Kuru Janapada c. 400-350 B.C.

Kuru coins are of silver and weigh 1/2 of the Karshapana weight standard. These have a composite symbol on the obverse and a blank reverse. These are square issues ranging from 7 x 11 to 11 x 12 mm in size. Symbols on these include: a fish with dots, a bull and an elephant with a rider (Fig. 14).

Malla Janapada c. 550-320 B.C.

Malla coins are archaic in appearance. They comprise a large central symbol punched heavily on the blanks (Fig. 15). Weights of these range from 6.6 to 6.8 g; 5.0 to 5.4 g, and 2.5 to 2.8 g. A few pieces reported from the Narhan hoard are blank planchets with a single impression.

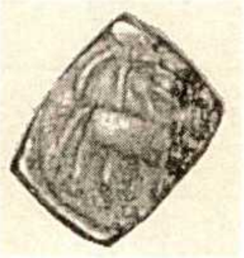


Fig. 14: Kuru coin

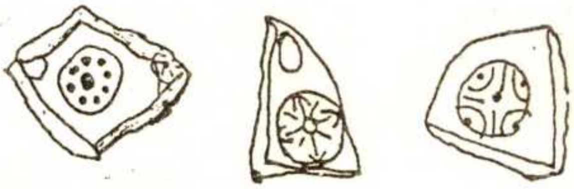


Fig. 15: Malla coins

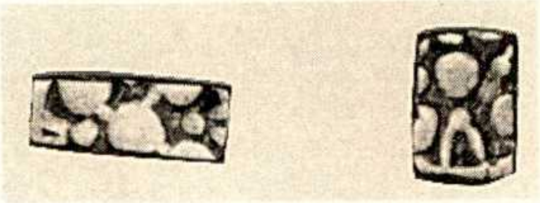


Fig. 16: Panchala coins

Panchala Janapada c. 400-350 B.C.

Silver coins of the Panchalas are found in three denominations, viz., 1/2 and 1/4 Karshapana, and Mashaka. The Mashakas weigh around 0.3 g; the 1/4 and 1/2 Karshapanas weigh around 1.0 g and 1.8 g respectively. They all have a large central symbol punched on the obverse (Fig. 16).

Shurasena Janapada c. 400-350 B.C.

Shurasena coins occur in two denominations, viz. 1/2 Karshapana and Mashaka. The former weigh around 1.8 g, and the latter around 0.3 g. These pieces consist of a large composite symbol comprising a lion on the right with a fish above it and some ancillary symbols all around (Fig. 17).

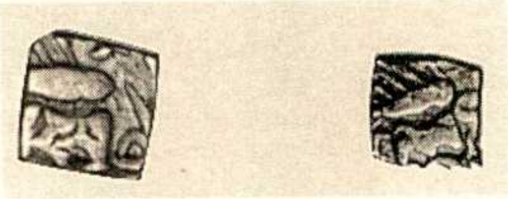


Fig. 17: Shurasena coins

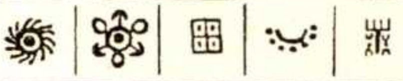
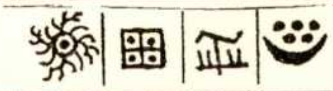
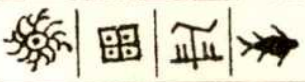
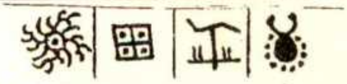
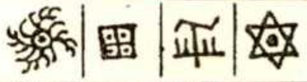
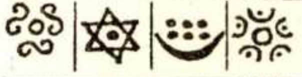
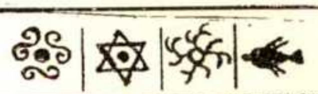
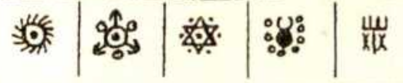
Vatsa Janapada c. 500-410 B.C.

Silver coins of the Vatsa Janapada have been issued on the four-symbol pattern. The series consists of a pair of one symbol and two different symbols (Hardaker 1981), and their weight varies from 3.1 to 3.5 g corresponding to the Karshapana standard.

Conclusion

Coined currency in early historic India followed a universal system of pictographs. According to this system, each state had a unique symbol which represented the issuing authority. Such symbols were exclusively employed by those states on their own coins. As far as the rest of the symbols are concerned, like the State symbol the other

Table 3: Some common symbols on the Janapada coins

Janapada	Main Symbols
Magadha	
Kāshi	
Kāshi	
Kāshi	
Kāshi	
Kosala	
Kosala	
Magadha	

symbols also had a hidden meaning. This can be gleaned from the fact that states like Kashi, Kosala and Magadha had a few common symbols among their own groups of symbols (Table 3). An in-depth study of these symbols also results in an internal chronology which is testified to the numismatic theories of weight and size reduction, and debasement of the metallic contents.

This preliminary study of the *Janapada* Punch-marked coins has opened up a new vista for numismatists. What is now required from archaeologists is positive stratified evidence to date these historic coins. Meanwhile, numismatists are expected to rediscover the encoding of these enigmatic pictographs on the *Janapada* Punch-marked coins.

Acknowledgements

My sincere thanks are due to Shiryuts Lance Dane, Shailendra Bhandare, J.P. Goenka, Anil Shah, Girish Veera, Dhiren Gala, Dilip Shah, P.P. Kulkarni, Pukharaj Surana, Daulal Johri, K.K. Maheshwari, Dinesh Mody, R.T. Somaiya, Haresh Gala, and Dr. S.K. Punshi for allowing me to study their coin collections. My heartfelt thanks are also due to Mr. Indukumar Pandey and Mr. Asfaq Ahmad of the State Museum, Lucknow; Dr. Savita Sharma of the Bharat Kala Bhavan, Varanasi; Dr. Reeta Devi Sharma of the National Museum, New Delhi, and Dr. Vijay Kumar of the Patna Museum for their sincere help and assistance in studying the museum collections. Many professional numismatists have helped with information and coin photographs. Mr. Ranvijaya Singh of Sultanpur was especially helpful by providing complete information about the coin hoards found in last two decades. Other coin professionals like S.L. Jain, Rakesh Jain, Jagdish Gupta, Shyam Kumar Bedi, Avinash Ramteke, Shatrughna Jain and Parimal Rupani have kindly allowed me to photograph and publish their coins for the present research.

To all these persons and institutions I express my deepest gratitude.

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Shellfishing and Shell Crafts during the Harappan Period in Gujarat

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Abstract

The earliest direct evidence for the utilisation of molluscan shells by human beings for various purposes comes from the Upper Pleistocene. In Indian archaeology, however, Malacology was, till recently a neglected subject. However, in the past two or three decades there has been an increasing awareness among archaeologists concerning molluscan shell studies, resulting in some important work on the Harappan sites, especially in Gujarat. In this paper, I have tried to compile data from published sources as well as included my own observations on shells from nine Gujarat Harappan sites. The study has revealed that shells were mainly utilized for food as well as in the shell industry. A more or less uniform pattern of molluscan exploitation is exhibited at these sites. The Harappan shell industry in Gujarat resembles that of Mohenjo-daro and Harappa in many respects. Seasonal harvesting of estuarine bivalves and gastropods at coastal sites contributed marginally to the food economy of the Harappans. Besides, the presence of certain habitat specific species has revealed that the micro-environment in the area comprised intertidal mud flats, mangrove swamps, etc.

Introduction

Molluscs are one of the earliest natural resources to have been exploited by human beings and can be traced back to the Middle and Upper Palaeolithic cultures of the Late Pleistocene period (Waselkov 1987). Molluscan shells because of their ornamental and durable nature were specially sought for making different kinds of objects. These were also fished from rivers, creeks, estuaries, etc. for their meat, and accumulations of their discarded shells over time resulted in the formation of "shell middens" or "kitchen middens", which have been reported from many of the coastal areas all over the world.

Fairly good preservation has been recorded for molluscs found at archaeological sites and hence they form ideal tools for reconstructing past cultural life ways. Molluscan studies were first initiated with the examination of "Kjokkenmoddings" or the Danish kitchen shell middens in the latter half of the 19th century (Lubbock 1869). Since then Malacology has become an integral branch of archaeology.

Freshwater, terrestrial and marine shells have been used to reconstruct various aspects of the human past such as the palaeoenvironment (Shackleton 1970; Klein 1972): chronology (Evans 1969; Burleigh and Kerney 1982): subsistence economy (Meighan 1969; Parmalee and Klippel 1974; Osborn 1977; Erlandson 1988): palaeoeconomy (Jackson 1917; Paulson 1974; Jensen 1963; Nations 1979): seasonality (Clark 1968; Coutts 1970; Koike 1973, 1977; Deith 1983, 1986): socio-religious aspects (Skeates 1991; Resse 1991), and so on (for a more exhaustive summary of shell midden studies see Waselkov 1987).

By studying modern shellfish collectors and the various aspects of this particular economy, I have been able to infer past molluscan exploitation patterns. One of the more comprehensive studies of this kind was done by Meehan (1982) on the Anbarras of North Arnhem Land in Australia.

Molluscan Research In Indian Archaeology

Today in spite of the appreciable quantities of shells recovered from various Indian archaeological sites, molluscan research still remains in its infancy. Dating from the prehistoric to the early historic periods the earliest evidence for the utilisation of shells is attested to at the Upper Palaeolithic site of Patne in Maharashtra (Sali 1980).

In the initial years of archaeological research Indian scholars were mainly concerned with describing and classifying the artefacts recovered from various excavations and explorations. As the main emphasis was on major finds, eg. pottery, stone tools, etc., faunal reports appeared only as appendices in excavation reports, and the shell remains merited only a brief mention.

Shell remains were first reported by Robert Bruce Foote from different parts of southern and western India (Foote 1887), but the significance of molluscan remains was realised much later with the discovery and excavations at Mohenjo-daro (Marshal 1931). Sewell and Guha (1931) gave a systematic account of shell remains from the site, and this was followed by Prashad's (1936) study from Harappa, making way for other reports like those from Nashik (Ray and Rajagopaliengar 1955), Maski (Nath 1957), Nevasa (Ray 1960), Chandoli (Shah 1965) Dwarka (Ansari and Mate 1966), Nagara (Shah and Mehta 1968), Somnath (Nanavati *et al.* 1971), etc. The reporting of shells from these sites was basically of a classificatory nature involving systematics, with an occasional mention of their use. However, no serious attempt was made to determine the exact role of molluscan shells in the cultural history of these sites.

A major part of molluscan research has focused on the utilitarian role of shells mainly the manufacture of bangles from *Turbinella pyrum*. This may have been due to the fact that *Turbinella* shell bangles are the most commonly found objects at many Indian protohistoric and historic sites. Hornell (1913; 1942) was the first to determine the antiquity of shell bangle manufacture in India through his observations on present-day shell working in Bengal.

After a long gap as waves of change passed through the discipline, in the early seventies, emphasis was placed on the study of biological material. An important breakthrough was achieved in the excavation at Inamgaon, a Chalcolithic site in Maharashtra where different cultural aspects of the Chalcolithic population were reconstructed with help of the biological, physical and social sciences.

It was around this time that Kenoyer (1983) reinvestigated the shell remains from Mohenjo-daro and Harappa resulting in a concise study of Harappan shell working seen at sites like Balakot, Harappa, Mohenjo-daro, Amri, Lothal, etc. (Kenoyer 1983, 1984a, 1985). Similar reconstruction was carried out at the Harappan site of Nageswar (Bhan and Kenoyer 1984) revealing for the first time a major shell working site within the country. Succeeding studies at Nagwada (Hegde *et al.* 1988), Surkotada (Joshi 1990), Shikarpur (Thomas *et al.* 1995) and Kuntasi (Deshpande 1995, 1996) have paved the way for molluscan studies in Indian Archaeology.

At Mohenjo-daro, Harappa and Chanhudaro, important centres of the Harappan civilization, molluscan shells played a significant role in the economy (Kenoyer 1984a). In the Harappan crafts industry, shell working constituted a well organised activity similar to other crafts such as bead manufacture, ceramics, etc. (Kenoyer 1983). While the importance of shells has been ascertained at these urban centres, the picture at the southern limits of this civilisation i.e. the Gujarat region remains fragmentary and unclear. Prior to the Harappan period small-scale utilisation of *Dentalium* shells is observed in this region from the Mesolithic sites of Lekhalia (Sahu 1988), Tarsang (*IAR* 1977-78) Kanewal (Mehta and Momin 1980) and Langhnaj (Sankalia 1965).

A large number of sites ranging from the Mature to the Late Harappan period have been reported from Gujarat. One of the reasons put forward for the occupation of Gujarat by the Harappans is the availability of different kinds of raw material, shell being one of them. This region is located very close to the prime source area for marine shells used in shell working, i.e. the Gulf of Kachchh. From this area shells were procured and transported to various centres within the Harappan domain. At a majority of the sites one encounters evidence in the form of shell objects and debitage. Therefore, in order to gain a proper insight into the nature of molluscan exploitation in Gujarat, shell evidence from a few excavated Harappan sites has been examined. Out of the numerous sites excavated, shell evidence from only nine sites is considered in this discussion because these are the only sites where substantial molluscan shell remains have been reported. Since the material, excepting that from Kuntasi, Shikarpur, Padri and Bagasra, has not been personally studied, I have had to depend mainly on published sources.

Table 1 and Fig. 1 describe the Harappan sites with molluscan finds discussed in this paper.

By comparing the shell evidence from these nine sites in Gujarat, I have suggested that there were primarily two reasons for molluscan exploitation: (Table: 2-4)

(i) as raw material for the production of different shell objects; and

(ii) seasonal collection of specific molluscs for dietary purposes.

The overall evidence indicates that at most of the sites, 90% of the molluscs represented are of marine origin. A wide range of species are met with at coastal sites like

Table 1: Shell studies from Harappan sites in Gujarat

Site	District	Location	Site Reference	Shell Reference
Surkotada	Kachch	23° 37’N;70 50’E	Joshi 1990	(Sharma 1990)
Shikarpur	Kachch	23° 05’N;70 37’E	IAR 1987-88	(Deshpande 1995)
Nagwada	Surendranagar	23° 24’N;71 41’E	Hegde *et al.*1988	(Hegde *et al.* 1988)
Nageswar	Jamnagar	22° 15’N;69 02’E	Hegde *et al.* 1992	(Bhan 1992)
Kuntasi	Rajkot	22° 53’N;70 32’E	Dhavalikar *et al.* 1996	(Deshpande 1995)
Bagasra	Rajkot	23° 3’N;70 37’E	Sonawane (pers. comm.)	(Per. obs.)
Lothal	Ahmedabad	22° 31’N;72 14’E	Rao 1985	(Chari 1985)
Malvan	Surat	21° 71’N;72 42’E	Allchin and Joshi 1995	(Shah 1995)
Padri	Bhavnagar	22° 22’N;72 95’E	Shinde 1992	(Joglekar 1996-97)

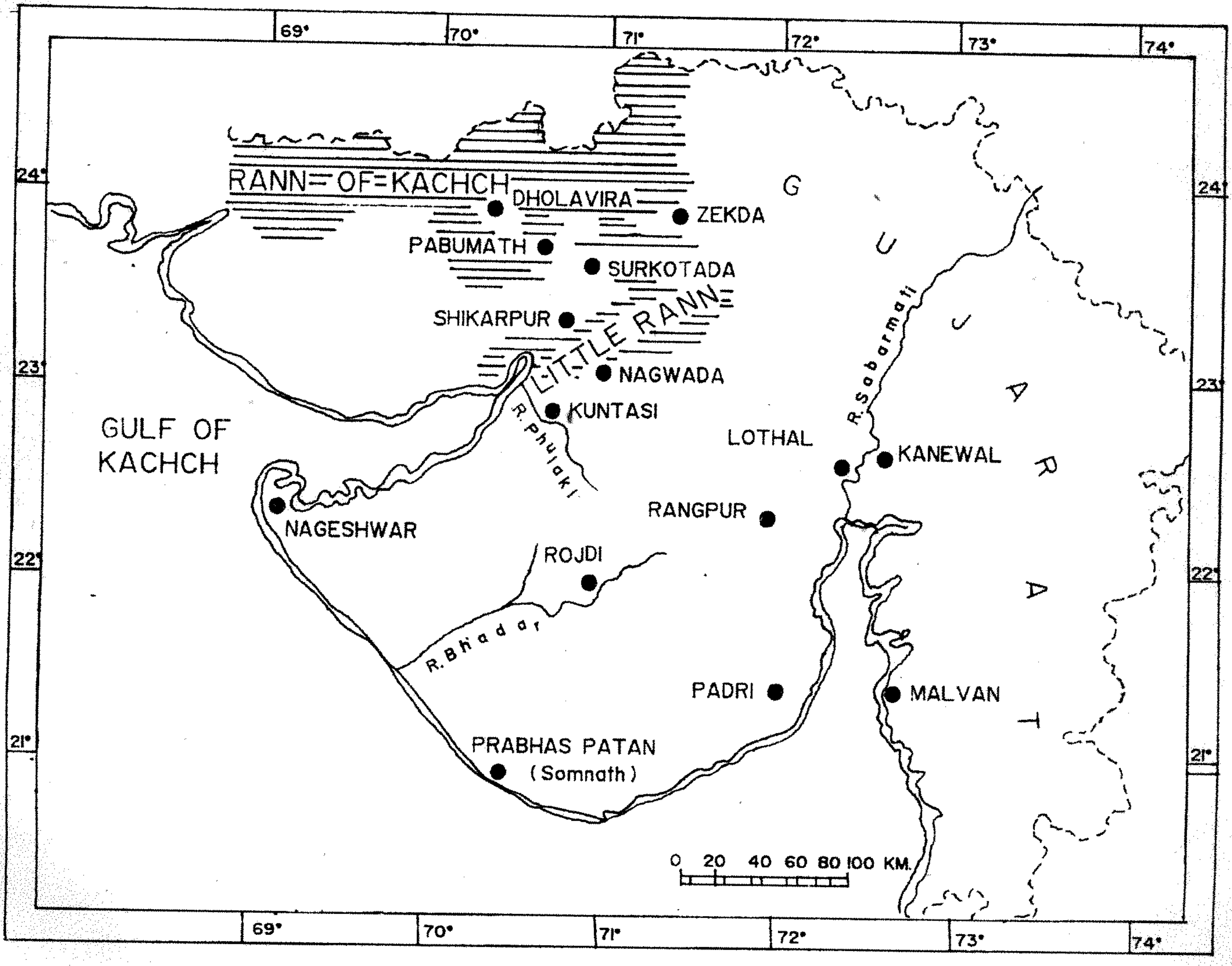

Fig. 1: Map of Harappan Sites in Gujarat as mentioned in the text

Table 2: List of marine bivalves at Harappan sites in Gujarat

SPECIES	**NGH**	**SKR**	**KTS**	**SKT**	**LTL**	**NGW**	**PDR**	**BGS**	**MVN**
Anadara rhombea	+	+	+	-	-	-	-	+	-
Anadara antiquata	-	-	-	-	+	-	-	-	-
Periglypta puerpera	-	-	+	-	-	-	-	-	-
Paphia gallus	-	-	+	+	-	-	-	+	-
Acanthocardia lata	-	-	+	-	-	-	-	-	-
Meretrix meretrix	-	+	+	-	-	-	+	+	+
Meretrix ovum	-	-	-	-	-	-	-	-	+
Meretrix casta	-	-	-	-	-	-	-	-	+
Callista impar	-	-	-	-	+	-	-	-	-
Marcia recens	-	-	+	-	-	-	-	-	-
Acanthocardia coronata	-	-	+	-	-	-	-	-	-
Cardites antiquata	-	-	+	-	-	-	-	-	-
Semele cordiformis	-	-	+	-	-	-	-	-	-
Apolumetis edentula	-	-	+	-	-	-	-	-	-
Pelecyora excisa	-	-	+	-	-	-	-	-	-
Chlamys thanquebaricus	-	-	+	-	-	-	-	-	-
Chlamys townsendi	-	-	-	-	+	-	-	-	-
Placuna placenta	-	-	+	-	-	-	-	+	-
Pinctada sp.	-	-	+	-	-	-	-	-	-
Pinctada margaritifera	-	-	-	-	+	-	-	-	-
Solen sp.	-	-	+	-	-	-	-	+	-
Crassostrea sp.	-	-	+	-	-	-	-	+	-
Spondylus exilis	-	-	-	-	+	-	-	-	-
Tivela damoides	-	-	-	-	+	-	-	-	-
Dosinia ceylonica	-	-	-	-	+	-	-	-	-
Pecten sp.	-	-	-	+	-	-	-	-	-
Mytilus viridis	-	-	-	-	-	-	-	-	+

Presence: + Absence: -

NGH-Nageswar	(Bhan 1992)	KTS-Kuntasi	(Despande 1995)
PDR-Padri	(Joglekar 1996-97)	BGS-Bagasra	(Deshpande per. obs.)
SKT-Surkotada	(Sharma 1990)	SKR-Shikarpur	(Deshpande 1995)
LTL-Lothal	(Chari 1985)	NGW-Nagwada	(Hegde *et al.*1988)
MVN-Malvan	(Shah 1995)		

Table 3: List of freshwater shells at Harappan sites in Gujarat

SPECIES	**NGH**	**SKR**	**KTS**	**SKT**	**LTL**	**NGW**	**PDR**	**BGS**	**MVN**
Lamellidens marginalis	-	+	+	+	+	-	-	-	-
Zootecus insularis	-	-	+	-	-	-	-	-	-
Zootecus chion	-	-	-	-	-	-	-	-	+
Lymnaea pinguis	-	-	-	-	-	-	-	-	+
Lymnaea acuminata	-	-	+	-	-	-	-	-	-
Viviparus bengalensis	-	-	+	-	-	-	-	-	-
Melania striatella tuberculata	-	-	+	-	-	-	-	-	-
Indoplanorbis exustus	-	+	+	-	-	-	-	-	+
Cryptozona semirugata	-	-	+	-	-	-	-	-	-
Parreysia favidens	-	-	-	+	-	-	-	-	-
Parreysia corrugate var. nagpoorensis	-	-	-	-	-	-	-	-	+
Corbicula regularis	-	-	-	+	-	-	-	-	-
Pila globosa	-	-	-	-	-	-	-	-	+

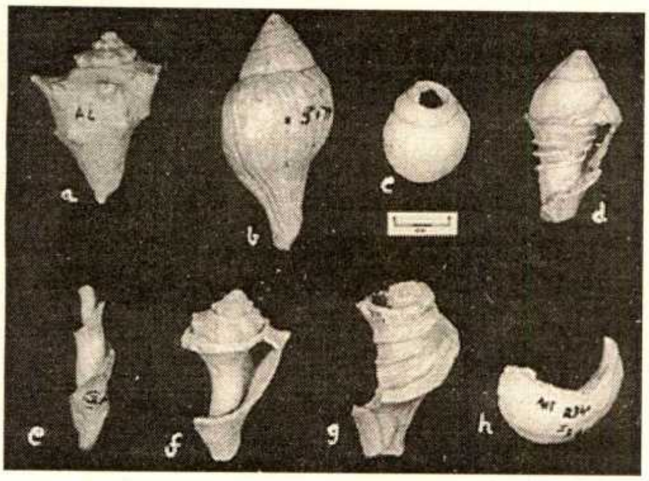

Fig. 2: a. *Pugilina buchephala*, b. *Turbinella pyrum*, c. *T. pyrum* perforated apex, d. *T. pyrum* columella with spire intact, e. *P. buchephala* columella, f. *P. buchephala* columella with spire intact, g. *T. pyrum columella*, h. fragment from *T. pyrum* shell whorl

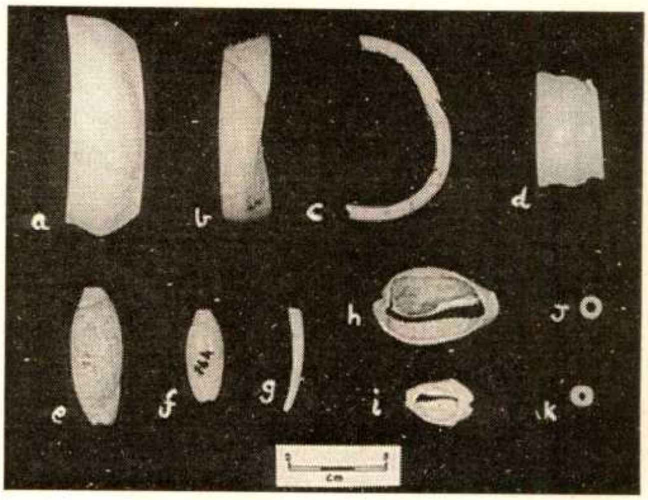

Fig. 3: a-d shell bangle fragments, e, f, *Agaronia nebulosa* perforated apex, g. *Dentalium shell*, h. sawn *Erosaria lamarcki*, i. sawn *Moneta moneta*, j, k. shell beads

Kuntasi, Bagasra, etc. primarily because of easy access to their collection areas as compared to inland sites. More than 50% of the shell remains at many of the sites have mostly resulted from shell crafts.

Industrial Use of Shells

Although the Gulf of Kachch and the Gujarat coast are host to numerous varieties of molluscs, only certain species were exploited in great numbers (Table 5). This might have been due to their large size and occurrence in colonies which guaranteed a continuous supply. These were the large gastropods *Turbinella pyrum*, *Chicoreus ramosus*, *Fasciolaria trapezium* and *Pugilina buchephala* (Fig. 2). The same species were the chief raw material at Mohenjo-daro and Harappa (Kenoyer 1983). *Lambis truncata sebae* reported from Mohenjo-daro and Harappa is scarce at sites in Gujarat, and there exists some doubt over the identification and presence here of *Fasciolaria trapezium* and

Table 4: List of marine gastropods at Harappan sites in Gujarat

SPECIES	**NGH**	**SKR**	**KTS**	**SKT**	**LTL**	**NGW**	**PDR**	**BGS**	**MVN**
Agaronia nebulosa	-	-	+	-	-	-	+	+	-
Thais carinifera	-	+	+	-	-	-	-	+	+
Thais sp.	-	-	-	-	+	-	-	-	-
Thais rudolphi	-	-	-	-	-	-	-	-	+
Lophiotoma sp.	-	-	+	-	-	-	-	-	-
Telescopium telescopium	-	+	+	-	+	-	-	-	-
Terebralia palustris	-	-	-	-	+	-	-	-	-
Architectonica laevigata	-	-	+	-	-	-	-	-	-
Polinices didyma	-	+	+	-	-	-	-	-	-
Natica sp.	-	-	+	-	-	-	+	+	-
Nerita chamaeleon	-	-	+	-	-	-	-	-	-
Nerita polita	-	-	-	-	+	-	-	-	-
Neritina crepidularia	-	-	-	-	-	-	+	-	+
Astraea semicostata	-	-	+	-	-	-	-	-	-
Cerithiidae cingulata	-	-	+	-	-	-	+	+	-
Cerithiidae fluviatilis	-	-	-	-	-	-	-	-	+
Diodora funiculata	-	-	+	-	-	-	-	+	-
Ellobium aurisjudae	-	+	+	-	-	-	-	-	+
Dentalium sp.	-	-	+	-	+	-	-	-	+
Turbinella pyrum	+	+	+	+	+	+	-	+	+
Pugilina buchephala	-	-	+	-	-	-	-	+	-
Ficus sp.	-	-	+	-	-	-	-	-	-
Cantharus spiralis	-	-	+	-	-	-	-	+	-
Turbo sp.	-	-	+	-	-	-	-	-	-
Tibia sp.	-	-	+	-	-	-	-	-	-
Chicoreus ramosus	+	+	+	-	+	-	-	+	-
Tonna sp.	-	-	+	-	-	-	-	+	-
Cypraea sp.	-	-	+	-	-	-	-	+	-
Babylonia spirata	-	-	+	-	-	-	-	-	-
Murex sp.	-	-	+	-	-	-	-	-	-
Turritella sp.	-	-	+	-	-	-	-	-	-
Lambis lambis	-	-	-	-	+	-	-	-	-
Erosaria turdus	-	-	-	-	+	-	-	-	-
Fasciolaria trapezium	+	-	-	-	-	+	-	-	-
Conus sp.	-	-	-	-	+	-	-	-	-
Moneta moneta	-	+	-	+	-	-	-	-	-
Gratiadusta pallida pallida	-	-	-	+	-	-	-	-	-
Cypraea tigerina	-	-	-	+	-	-	-	-	-
Clausdia laminista	-	-	-	+	-	-	-	-	-
Hyalinia collaria	-	-	-	+	-	-	-	-	-
Turritella communis risso	-	-	-	+	-	-	-	-	-
Turbonila scalaris	-	-	-	+	-	-	-	-	-
Natica merochiensis	-	-	-	-	-	-	-	-	+
Cymatium cingulata	-	-	-	-	-	-	-	-	+
Ficus ficus	-	-	-	-	-	-	-	-	+
Melampus fasciatus	-	-	-	-	-	-	-	-	+
Littorina scabra	-	-	-	-	-	-	-	-	+
Cantharus spiralis	-	-	+	-	-	-	-	+	-

Table 5: List of molluscs used in the shell industry in Gujarat

SPECIES	**NGH**	**SKR**	**KTS**	**SKT**	**LTL**	**NGW**	**PDR**	**BGS**	**MVN**
Turbinella pyrum	+	+	+	+	+	+	+	+	+
Chicoreus ramosus	+	+	+	-	+	-	-	+	-
Pugilina buchephala	-	-	+	-	-	-	-	+	-
Fasciolaria trapezium	+	-	-	-	-	+	-	-	-
Agaronia nebulosa	-	-	+	-	-	-	+	+	-
Dentalium sp.	-	-	+	-	+	+	-	-	+
Polinices didyma	-	+	+	-	-	-	-	-	-
Natica sp.	-	-	+	-	-	-	+	+	-
Nerita chamaeleon	-	-	+	-	-	-	-	-	-
Nerita polita	-	-	-	-	+	-	-	-	-
Neritina crepidularia	-	-	-	-	-	-	+	-	+
Ficus sp.	-	-	+	-	-	-	-	-	-
Cantharus spiralis	-	-	+	-	-	-	-	+	-
Turbo sp.	-	-	+	-	-	-	-	-	-
Tibia sp.	-	-	+	-	-	-	-	-	-
Tonna sp.	-	-	-	-	-	-	-	-	-
Placuna placenta	-	-	+	-	-	-	-	+	-
Pinctada sp.	-	-	+	-	-	-	-	-	-
Pinctada margaritifera	-	-	-	-	+	-	-	-	-
Anadara rhombea	-	-	+	-	-	-	-	-	-

Pugilina buchephala. Both species closely resemble each other. *Fasciolaria* is a large shell with an elongated spire and its columella has low columellar folds or grooves, while that of *Pugilina buchephala* is slightly smaller with a short spire and the columella is devoid of any folds. *Fasciolaria trapezium* has been reported from Lothal (Chari 1985), Nageswar and Nagwada (Bhan 1992). However, my personal observation on these shells suggests that they are most likely *Pugilina buchephala* and not *Fasciolaria* species. Hence, further detailed analysis of the material is required to confirm the identification of these two species.

Other shells used in shell working were *Placuna placenta*, *Dentalium* sp.,*Anadara* sp., *Agaronia nebulosa*, etc.

Presently *T. pyrum var. acuta* shells are fished from the Jamnagar coast between Sachhana and Okha from the seaward rims of the patchy coral reef areas from a depth of 4-6 m. Fishing is done by communities such as Sindhis, Varghers, Meghwars, etc. throughout the year but fishing at low tide during spring tides is generally preferred (Pota and Patel 1991a). As compared with the *T. pyrum* localities on the Tamil Nadu coast, these areas are much shallower and are easily approached at low tide (Nayar and Mahadevan 1973). The large murex shell *Chicoreus ramosus* is found attached to coral reef areas. *Pugilina* and *Fasciolaria* are also found in similar habitats. Good quality shells belonging to all the four species appear to have been procured in the size range of 50-200 mm, except for *Chicoreus ramosus* which is slightly larger in size.

The *Placuna placenta* shells used for pendants at Kuntasi were smaller than the prescribed modern fishery size of 11.4 cm. (Deshpande 1995). *Placuna placenta* fisheries today form a major industry in the Gulf of Kachch. Its poor quality pearls are used in the medicine industry. It inhabits the muddy bottoms of the intertidal zone of the Pindara bay at a depth of 4 m and is harvested throughout the year (Pota and Patel 1991b). Other notable localities are Karachi Harbour, the Mumbai creeks, etc. Untill fifty years ago revenues were regularly collected from these fisheries by the Gujarat State and form a part of the royal patronage (Hornell 1951).

The collection of smaller gastropod and *Dentalium* shells was either by beach combing or by dredging from sandy/muddy tidal flats.

Shell objects

At a majority of the sites the industrial debitage from these shells outnumbers the shell objects, whose variety in Gujarat is limited when compared with Mohenjo-daro or Harappa. A wide variety of objects were recovered from Lothal while, very few objects are present at Malvan and Padri. Industrial shell waste is mainly represented by columella, columellas with spires intact, diagonally sawn spire portions, outer shell whorl fragments and small chips (Fig. 2).

Bangles from *T. pyrum* comprise the main shell objects produced. The species *C. ramosus*, *Fasciolaria* and *Pugilina* were also used, e.g. *C. ramosus* bangles at Nageswar (Bhan 1992) and *Pugilina buchephala* at Kuntasi (Deshpande 1995). At the majority of sites in Gujarat, the bangles are mostly plain though some have the chevron motif (Fig. 3; a-d). Bangle widths cover a broad range comparing well with Mohenjo-daro bangles whose widths ranged from 2–44 mm; this wide range being a stylistic feature and not the result of differences in manufacturing traditions (Kenoyer 1984a). Similar bangles are present at Kuntasi (Deshpande 1995) and Nageswar (Bhan 1992).

Bangles, are also reported from Somnath (Nanavati *et al.* 1971), Rangpur (Kenoyer 1983), Zekhada (Momin 1980-81), Pabumath (IAR 1977-78), Rojdi (*IAR* 1982-83), Dholavira (Bisht 1989-90), etc. (Fig. 1). Certain bangles from Lothal reported by Kenoyer (1983) have a wide squared channel around the circumference of the bangle. A few similar bangles are also reported from Surkotada (Joshi 1990; Kenoyer 1983) and Kuntasi (Deshpande 1995). Such bangles became common towards the Early Historic period. Bangles fashioned from *Callista Meretrix casta* found at Balakot (Kenoyer 1983) are absent at the Gujarat sites.

Ladles from *C. ramsous* were produced at Lothal, Nageswar, Kuntasi and Shikarpur. Not a single finished ladle is present at Kuntasi but its shell wastes suggest its manufacture (Fig. 4). A specialised technique was involved for the removal of one or two ladles from a single *C. ramosus* shell (Kenoyer 1983). Ladle manufacture in Gujarat probably continued into the Late Harappan period as seen at Kuntasi. In this period there appears to be more use of *C. ramosus* as compared to the Mature Phase (Deshpande 1995).

At most of the important sites like Lothal, Nageswar, Nagwada and Kuntasi the complete use of large gastropod shells is apparent. So that besides using the main shell whorl, the resulting shell debitage was further used for making the following objects.

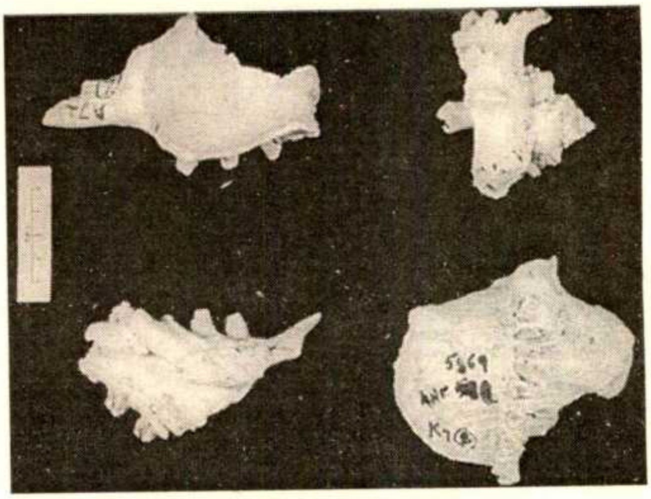

Fig. 4: *Chicoreus ramosus* shell waste

(a) The apex portions of *T. pyrum* were used to make rings as observed at Nagwada.

(b) Outer shell fragments were made into inlays and beads. Finished inlay pieces were produced at Lothal, Nageswar and Nagwada. The waste of *T. pyrum*, *Pugilina*, *Chicoreus* and *Fasciolaria* was also used for making inlay pieces. Sometimes *Fasciolaria trapezium* and *Pugilina buchephala* were used only for inlay manufacture as at Nageswar and Nagwada. At Mohenjo-daro shell inlays were manufactured only from *F. trapezium* and *Lambis truncata sebae* (Kenoyer 1984b, 1985). At Nagwada *T. pyrum* waste fragments were made into inlays and the most common shapes are circular discs and triangular pieces (Hegde *et al.*1988). Some of them had beveled edges probably for insertion into wood or clay (Hegde *et al.* 1988).

(c) Beads in a variety of shapes have been found at Lothal, Surkotada, Nagwada, Kuntasi, Padri, etc. Beads were probably made from the outer shell fragments of the large gastropods (Fig. 3). Lothal was among the important lapidary centres in the Harappan period. A bead factory with a working platform in an open courtyard surrounded by 11 rooms was laid bare in Block E near the acropolis indicating bead manufacture (Rao 1985). Some commonly found forms at Lothal were barrel, truncated, convex, biconvex and disk. Surkotada also has evidence for shell bead manufacture, the shapes being cubical, biconvex, cylindrical, spherical, tubular and barrel (Joshi 1990).

(d) The columella of *T. pyrum* shells was used to make objects like beads, inlays, gamesmen, chisels, etc. Grooves of the columella were smooth down to make beads at Kuntasi (Fig. 5). Columellar beads continue

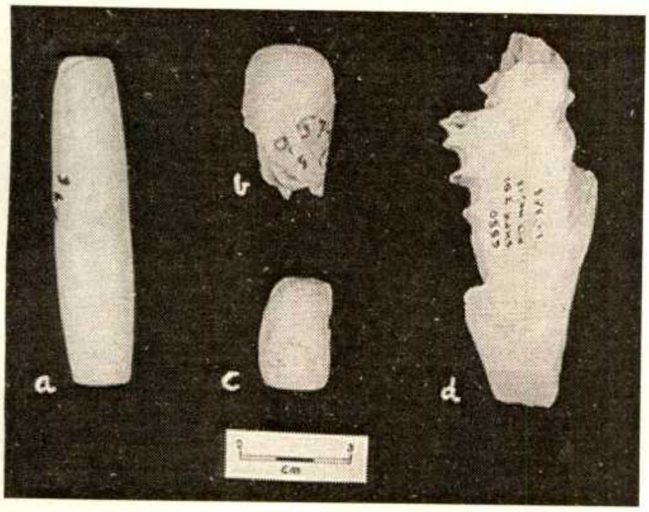

Fig. 5: a,b,c. Objects from *T. pyrum* columella, d. Columella of *T. pyrum* made into a chisel like object from Shikarpur

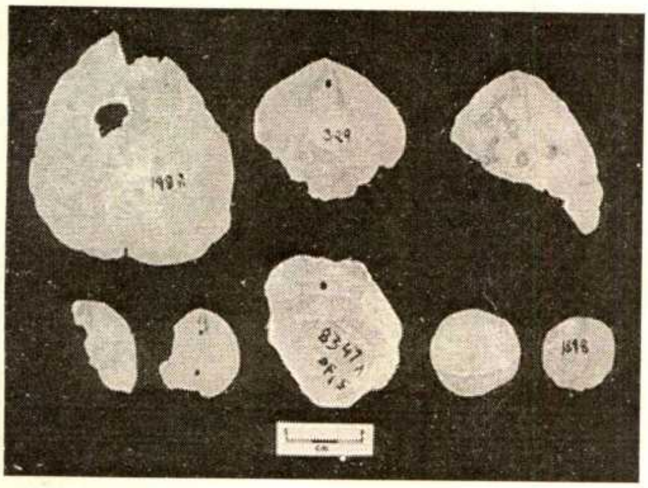

Fig. 6: *Placuna placenta* shell pendants from Kuntasi

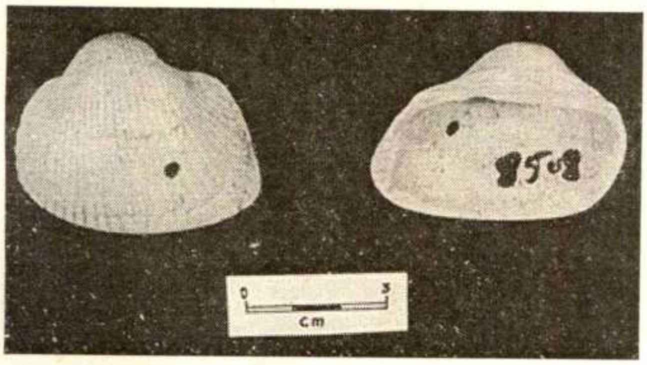

Fig. 7: Perforated *Anadara* shells from Kuntasi with edge ground margins

to be used by the Naga tribes in North Eastern India (Hutton 1926; Jacobs 1990). At Nagwada the columellar ridges were smoothed out and the columella was cut into circular discs with a thickness of 2 mm (K.K. Bhan: personal communication). One columella at Shikarpur had one end fashioned like a chisel (Deshpande 1995) (Fig. 5d).

Besides these, certain objects were unique to a particular site. At Kuntasi flat, circular, double to singly perforated pendants of 3 to 11 cm were manufactured using the windowpane oyster *Placuna placenta* (Fig. 6). So far these have not been reported from any other Harappan site probably because of their very fragile nature. Such pendants display a simple manufacturing technology.

Other objects produced were those from the bivalve *Anadara* sp. as observed at Kuntasi. The serrated margins of these shells appear to have been rubbed into a straight smooth edge and a few are perforated near the umbo (Fig. 7). They could have been used as scarpers, spoons or as pendants.

Small shells of *Agaronia nebulosa, Natica* sp., *Cypraea* sp., *Erosaria lamarcki, Nerita* sp., *Dentalium* sp. at Kuntasi, Shikarpur and Padri, were made into beads and pendants (Fig. 3), involving simple techniques like gouging, boring, and rubbing to perforate the shells.

So far since none of the sites have reported pearls, there is no direct evidence for pearl fishing. Hence very little can be said about this activity during the Harappan period in Gujarat. However, today in the Gulf of Kachchh, the coral reef areas have scattered beds of pearl oysters which produce poor quality pearls. These are fished even today and Hornell (1951) has reported that they were also collected by the Nawab of Jamnagar in the early part of the century. At Kuntasi the pearl oyster *Pinctada* sp. occurs in very few numbers. According to Rao (1991) the coastal sites of Amra, Lakhabawal and Nageswar may have been engaged in pearl fishing.

Certain objects displaying highly skilled craftsmanship like the shell compass at Lothal (Rao 1985) or the spherical shell object at Nagwada (Sonawane 1994-95) pose difficulty in identifying their.mode of manufacture.

Shell technology

The occurrence of bangles with specific dimensions and the similarity of various objects from sites in Gujarat, suggest a homogeneity in the shell working technology at most sites in this region.

After the successful attempts at reconstructing Harappan shell technology by Hornell (1942), Durante (1979a), Kenoyer (1983), Bhan and Kenoyer (1984) and Deshpande (1995) an understanding of the Harappan mode of bangle manufacture was achieved. This was possible through the use of ethnographic observations on the present day shell bangle industry in Bengal. Today, bangles are today produced only in the eastern part of the Subcontinent in West Bengal as well as East Bengal, now Bangladesh, e.g. Vishnupur, Calcutta, Barackpore, Dacca, etc. Detailed studies conducted by the above workers have helped to provide an insight into various aspects of present-day shell working as well as the socio-economic conditions of the shell workers. At all the Harappan sites a similarity in the techniques used is commonly observed: the diagonal technique of sawing the shell to produce bangle circlets as well as the horizontal method was used, e.g. Kuntasi. A similar method was reported by Durante for Shahr-i-Sokhta (Durante 1979a) and Balakot (Durante 1979b). This latter technique is rarely reported and some mention of its recent use at Dacca has been made in the Eastern Bengal Gazetteer (Allen 1912).

In spite of the widespread occurrence of shell waste at most of the sites, the tools used in shell cutting are rarely recovered along with these objects. Chert and copper drills, saws and knives may have been used for different kinds of shell working. However, since one seldom comes across these tools in context with shell waste it becomes difficult to ascertain which were the actual instruments used at different stages of shell working. At Surkotada, copper chisels, celts, knives, and crescent-shaped blades were found (Joshi 1990). Chert drill bits were found with unfinished beads at Nagwada (Hegde *et al.* 1988). Present day shell cutting in Bengal utilises a semi-circular iron saw with a bidenticulate edge. Kenoyer has postulated the use of a similar type of copper/bronze saw in the Harappan context (Kenoyer 1984a).

For the manufacture of *Placuna placenta* pendants the simple technique of trimming the edges of the shell was achieved probably by filing. While perforating was done with very fine needles or other sharp pointed objects (Deshpande 1995).

Identification of shell working areas

Shell working appears to have been carried out at different sites in varying proportions depending on the geographical location, nature of the site and proximity to a shell source. Activity areas have been identified at Lothal, Nageswar and Kuntasi. The systematic surface survey carried out at Nageswar revealed four areas of shell working. On the northwestern side, preliminary preparation of Chank shell took place while on the northern side inlay manufacture

Table 6: List of edible bivalves at Harappan sites in Gujarat

SPECIES	**NGH**	**SKR**	**KTS**	**SKT**	**LTL**	**NGW**	**PDR**	**BGS**	**MVN**
Anadara rhombea	+	+	+	-	-	-	-	+	-
Anadara antiquata	-	-	-	-	+	-	-	-	-
Periglypta puerpera	-	-	+	-	-	-	-	-	-
Paphia gallus	-	-	+	+	-	-	-	+	-
Acanthocardia lata	-	-	+	-	-	-	-	-	-
Meretrix meretrix	-	+	+	-	-	-	+	+	+
Crassostrea sp.	-	-	+	-	-	-	-	+	-
Meretrix ovum	-	-	-	-	-	-	-	-	+
Meretrix casta	-	-	-	-	-	-	-	-	+
Trachycardium enode	-	-	+	-	-	-	-	-	-
Callista impar	-	-	-	-	+	-	-	-	-
Marcia recens	-	-	+	-	-	-	-	-	-
Acanthocardia coronata	-	-	+	-	-	-	-	-	-
Cardites antiquata	-	-	+	-	-	-	-	-	-
Pelecyora excisa	-	-	+	-	-	-	-	-	-
Mytilus viridis	-	-	-	-	-	-	-	-	+
Lamellidens marginalis	-	+	+	+	+	-	-	-	-
Parreysia favidens	-	-	-	+	-	-	-	-	-
Parreysia corrugate var. nagpoorensis	-	-	-	-	-	-	-	-	+

from shell wasters was carried out. Ladles and bangles were manufactured on the southwestern side while in the fourth area only bangles were produced (Bhan 1986; Sonawane 1992).

At Kuntasi spatial analysis of the economically important gastropods and their debitage has also helped in locating shell activity areas. The spatial distribution revealed that shell working was carried out all over the site but was mainly concentrated in the Southwestern Industrial Complex in both the Mature and Late Harappan periods. No major shift in areas took place from one period to the other. Further the preliminary cutting of shells was not confined to one area, suggesting the possibility of different shell cutting workshops within the site (Deshpande 1995). At Vishnupur, bangle manufacture is a household industry (personal observation). A similar case was observed at Kuntasi where shell debitage has been found associated with structures identified as habitation areas i.e. the northern, eastern and southern areas.

Recycling

Not much recycling of shell objects or shell waste is seen at most sites. At Lothal a few bangle fragments were probably used to engrave and burnish or as scrapers, etc. (Rao 1985). Shell waste could have been burnt for lime manufacture as observed at Vishnupur in West Bengal (Deshpande 1995).

Dietary Role of Molluscs

So far not much emphasis has been laid on the part played by molluscs in the Harappan food economy. The role of shells appears mainly related to crafts (Sonawane 1992). However, the occurrence of bivalves in large numbers at Kuntasi and some of the other coastal sites strongly suggests shellfishing for dietary use. The Harappans are known to have exploited a wide variety of animal resources. It was at coastal sites where marine fish and shellfish were equally important (Dales and Kenoyer 1977; Meadow 1979), e.g. Balakot (Durante 1979b) and Allahdino (Turnbull 1983) that have yielded a fair amount of evidence for shellfishing in the Harappan context.

By studying those shells which represent food refuse from such sites it has been possible to try and infer the nature of the utilisation of marine resources, chiefly molluscs. Among the various coastal Harappan sites, evidence has been obtained from Kuntasi and Shikarpur. At a few sites like Padri, Lothal, Malvan and Nageswar a few edible bivalve species similar to those reported at Kuntasi are also present and probably served the same purpose. The site of Bagasra close to Kuntasi and currently being excavated is also yielding ample evidence for this aspect. However, the exact degree of exploitation is difficult to estimate since no shell quantification has been carried out as was done for Kuntasi. By comparison of species representation at different sites an overall picture of the dietary role of molluscs can be visualised (Table 6 and 7).

Further dietary use of shells has been also inferred from modern shellfishing sources.

Type of species harvested

A majority of the edible molluscs were of marine-estuarine origin, in addition a few freshwater species were also seen. There was a general preference for bivalves as compared to gastropods (Table 6 and 7). Fairly detailed studies on the nature of exploitation has been carried out for Kuntasi (Deshpande 1995), where nine bivalves contributed to the food economy (Table 8). Among these the dominant species were *Anadara rhombea*, *Paphia gallus* and *Meretrix meretrix* (Deshpande 1994). Some of the commonly represented bivalves and gastropods at different sites are as follows:

Table 7: List of edible gastropods at Harappan sites in Gujarat

SPECIES	NGH	SKR	KTS	SKT	LTL	NGW	PDR	BGS	MVN
Agaronia nebulosa	-	-	+	-	-	-	+	+	-
Thais carinifera	-	+	+	-	-	-	-	+	+
Thais sp.	-	-	-	-	+	-	-	-	-
Thais rudolphi	-	-	-	-	-	-	-	-	+
Lophiotoma sp.	-	-	+	-	-	-	-	-	-
Telescopium telescopium	-	+	+	-	+	-	-	-	-
Terebralia palustris	-	-	-	-	+	-	-	-	-
Pila globosa	-	-	-	-	-	-	-	-	+

Table 8: List of edible molluscs at Kuntasi

Name	Family	Class	Type
Trachycardium enode	Cardiidae	BV	M
Anadara rhombea	Arcidae	BV	M
Periglypta puerpera	Veneridae	BV	M
Paphia gallus	Veneridae	BV	M
Acanthocardia lata	Cardiidae	BV	M
Lamellidens marginalis	Unionidae	BV	FW
Meretrix meretrix	Veneridae	BV	M
Marcia recens	Veneridae	BV	M
Crassostrea sp.	Ostreidae	BV	M

BV: Bivalve M: Marine FW: Freshwater

Meretrix meretrix: a small hard backwater clam is reported from Kuntasi, Bagasra, Malvan and Shikarpur (Fig. 8: f, g). At Kuntasi undersized shells in the range of 20-40 mm were collected. Hornell (1917) had reported that they were eaten by the Valayans and the Palyans on the Tamil Nadu coast. Apart from *Meretrix meretrix*, *Meretrix casta* is also present at Malvan.

Paphia gallus: this is an ovate venerid clam with concentric lines on its outer glossy surface (Fig. 8 d, e). It was the most commonly found shell at Kuntasi, and was also found at Shikarpur and Bagasra.

Anadara sp.: these belong to the family Arcidae and are commonly referred to as blood cockles due to their red meat which is rich in iron. Its shell has a taxodont dentition and is hard, radially ribbed and covered with periostracum (Fig. 8 b, c). *Anadara rhombea* was found in great numbers at Kuntasi. It is also present at Bagasra and Shikarpur. At Nageswar "Arica" sp. have been reported, but these are probably *Anadara* sp. (personal observation). *Anadara granosa* was exploited extensively in the northern coastal areas of Australia (Roberts 1994). Today, *Anadara* sp. is not a popular food item in India and is collected mostly in the Kakinada bay on the Andhra coast for its shell which is burnt to extract lime (Narasimham 1991).

At Kuntasi, a majority of the bivalves measure 40-60 mm in length and 20-60 mm in breadth. *Anadara* sp. and *Paphia* sp. have a wider size range. Both these species were heavily exploitated in the Mature Harappan period, consequently undersized shells were also present.

Other bivalves collected were mostly the venerid clams like *Marcia recens* and shells of the Carditidae group. Although the Gujarat coast has large oyster beds mainly *Crassostrea gryphoides*, not many of the sites have reported its occurrence. The *Crassostrea* sp. probably *gryphoides* was collected in the Late Harappan period at Kuntasi (Fig. 8 a). Large sized specimens with the majority measuring between 100-120 mm in breadth and 60-80 mm in length were found and compare well with the present-day marketable size around 70 mm of *Crassostrea madrasensis* from the Tamil Nadu coast (Rao 1974). A few fragments are observed at Bagasra (personal observation). Besides Gujarat, *Crassostrea* sp. are reported from Balakot and Allahdino along the Sindh and Makran coast.

Further, some of the freshwater bivalves like *Lamellidens marginalis* and *Parryesia* sp. also had probably contributed to the diet and were found at most of the sites but in small quantities.

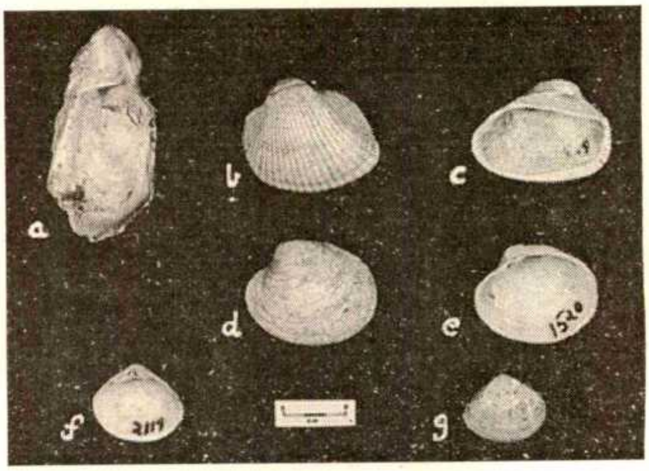

Fig. 8: a. *Crassostrea* sp., b,c. *Anadara rhombea*, d,e. *Paphia gallus*, f,g. *Meretrix meretrix*

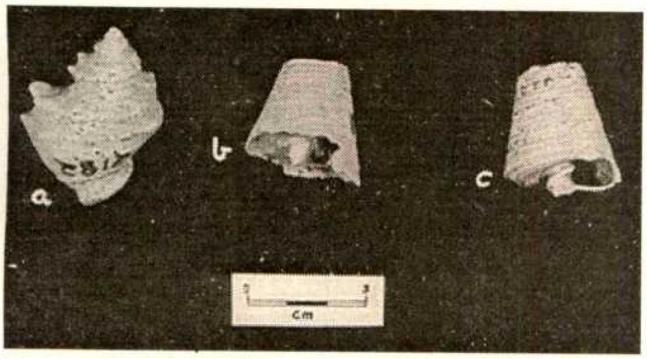

Fig. 9: a. *Thais carinifera*, b, c. *Telescopium telescopium* with broken apex

A few gastropods also collected specifically for food are the *Thais* sp., *Telescopium telescopium* and *Terebralia palustris* which are found associated with mangroves in mud flat areas (Fig. 9). *Thais carinifera* has been reported at Kuntasi, Shikarpur, Bagasra and Malvan. In present times its counterparts *Thais bufo* and *Thais rudolphi* form good fisheries on the Konkan coast (Jhingran 1983; Sundaram 1974). *Telescopium telescopium*, a conical shell with an acute spire was present at Kuntasi, Bagasra and Lothal. At Lothal and Kuntasi the apex of the shell was broken, probably indicating meat removal. Similarly broken *Telescopium* shells have been observed by Meehan while studying the shellfishing activities of the Anbarra in Australia. The Anbarras extract the meat by breaking the apex and by sucking it out (Meehan 1982). Presently, in India this species is collected from the swampy deltas of the Ganga, Krishna, Godavari as well as along the Konkan coast (Sashtri 1962).

Terebralia palustris another conical gastropod was consumed at Balakot (Meadow 1979) and Allahdino (Turnbull 1983). It was also extensively exploited at Qurum, a cluster of shell-middens on the Oman coast dating to the 5th and 4th millennia B.C. (Biagi *et al.* 1984). In Gujarat it is represented only at the site of Lothal. The presence of *Telescopium* and *Terebralia palustris* at sites is of significance since these can yield important palaeoenvironmental information regarding the Gujarat shoreline in the past, as well as on the distribution of mangrove swamps along the coast.

Meat from some of the large gastropods like *T. pyrum* might have also been consumed locally, prior to the trading in shells. This practice is similar to that on the Tamil Nadu coast where the Parawas extract the meat before handing the shells over to the Government (Nayar and Mahadevan 1974).

Edible species continue to be collected for the same purpose even today along the west and east coasts. Since shell quantification has not been carried out for most of the sites, it is difficult to detect any change in species preference over time. At Kuntasi a similar species representation in both the Mature and the Late Harappan periods suggests that there was not much change in exploitation strategies. While a change in species dominance from the Mature to the Late Harappan period was probably due to the over exploitation and non-availability of certain species caused by environmental changes brought about by sea level fluctuations (Deshpande 1995). It has been observed that *Paphia gallus* and *Anadara rhombea* which were dominant in the Mature Phase declined and were replaced by *Crasosstrea* and *Lamellidens marginalis* in the Late Harappan period.

Seasonality

Marine molluscs have specific seasons of spawning, maturity and growth which are governed by factors such as salinity, water temperature, turbidity, current velocity, etc. Hence, their collection is seasonal according to their availability. Shellfish meat is considered best before it spawns, therefore harvesting is done prior to spawning. On the Indian coast different species have different harvesting periods hence collection takes place all year round except during the monsoon period. This could also have been the case with coastal Harappan sites in Gujarat during the Harappan period. Modern fishing seasons for some of the species on the west coast of India are December to May, e.g. *Crassostrea gryphoides* (Alagarswamy and Narasimham 1973). In the case of *Paphia gallus* January to July are the most favorable periods (Nayar and Mahadevan 1974). While *Meretrix meretrix* is fished all year round. For more precise seasonality estimation, application of growth line and oxygen isotope techniques on shells from some of the coastal sites are necessary.

Procurement areas and methods

The occurrence of estuarine brackish water molluscs suggests that edible molluscs were mainly procured from the sandy/muddy tidal flats at low tides. Collection was probably by handpicking, dredging and detaching, simple methods all in use even today. The bivalves can be hand-picked or dredged from the mud flats while oysters, and gastropods can be detached from rocks and mangroves with a sharp instrument.

In North Kanara, the collection of *Paphia malabarica* is done in slightly deeper waters by means of nets locally called "Akhya" (Alagarswami and Narasimham 1973). On the Gujarat coast at Harshad, *Crassostrea gryphoides* are collected from a depth of 1.5-2.0 m at low tide by the Kharva families of Miyani village using hammers and chisels (Nariya and Patel 1991).

During the Harappan period, shellfishing might have been an activity carried out by women and children. Much of the ethnographic literature on modern shellfish gatherers indicates that they are the prime collectors. Easy access to shell beds might have made shell collection quicker.

Processing methods

At most of the sites like Kuntasi and Bagasra a majority of the shells are complete indicating that the meat was extracted without breaking the shells, and this is true for the species *Anadara* and *Meretrix*. In case of *Paphia* sp., however, the shells might have been broken after being discarded since these are not very sturdy shells. Some of the commonly used present-day processing methods are boiling, roasting, steaming, etc. At Kuntasi only very few shells of *Crassostrea* and *Paphia* show charring, indicating the probable roasting of the shells. For most of the clams, meat can be easily removed by steaming or putting the shells in boiling water. They are very seldom broken since this results in damaging the meat inside.

In case of *Thais* sp. commonly called "rock whelks" and found along the Konkan coast, the meat is extracted by boiling, while the meat of *Meretrix* is extracted by breaking the shells which are also boiled (Rai 1932). There is no direct evidence to indicate that dried shellfish meat was stored during the Harappan period. Today the dried meat of clams is sold at Malvan on the west coast (Alagarswami and Narasimham 1973).

Recycling and other uses

In the past not much recycling was done with the discarded shells. On the Indian coast today shells are collected and burnt for lime which may have been produced in a similar way at protohistoric sites since lime-daubed floors were quite common during that period. At Mohenjo-daro, Marshal has reported a large concentration of oyster shells from one room in the HR area (Section B, Block 2, House X Room 135) which might have been used for making plaster (Marshal 1931). The use as scrapers, cups, etc. of empty shells after discard is visible in the case of *Anadara* sp.

Overall dietary contribution

Molluscs although rich in proteins and minerals have never been the main dietary resource for any of the coastal communities. In fact studies by Noli and Avery (1988) have shown that coastal hunter-gatherers cannot subsist on marine animals or shellfish alone since an excessive intake of proteins can lead to protein poisoning. Studies on the nutritional composition of some of the Indian shellfish has shown that the protein composition of *C. madrasensis* is 5.72-13.31%, *L.marginalis* is 14.50% and of *Meretrix casta* it is 5.96-12.29% (Sastri 1962). Probably in Harappan times molluscs had served as a supplementary food source in the coastal Harappans diet in Gujarat.

Conclusions

From an overall examination of the shell evidence from the sites studied in Saurashtra, Kachch and mainland Gujarat, I have tried to suggest the likely role of molluscs in the economy of the Gujarat Harappans. The overall species representation implies a regular planned shellfishing strategy executed by the Harappans. Shell exploitation was mainly for shell crafts which were as important as those of other allied industries as seen from their widespread occurrence at various sites. The use of the four large gastropods for making objects other than bangles reflects the socio-economic importance of shells among the Harappans in Gujarat. Even though shells were easily available, the regular demand for objects other than bangles probably led to the complete utilisation of the shells.

Although shell working was an organised industry, its intensity varied depending on the accessibility and availability of shells. As compared to the major centres, the range of shell objects was limited and their manufacture was for both local use as well as for export. The technology was quite advanced and innovative, but also fairly uniform as is reflected at most sites. The Gujarat shell industry shares affinities technologically, (e.g. in the type of objects produced), with Mohenjo-daro and Harappa in all aspects of shell working. In Gujarat this particular industry continued to flourish upto historic times mainly due to its proximity and easy access to the Gulf of Kachch from where shells continued to be procured.

Besides shell working, another important aspect that emerges from this study is the dietary contribution of select molluscs to the Harappan food economy. At the coastal sites of Kuntasi, Shikarpur, Nageswar, Bagasra, etc. seasonal harvesting of shellfish at low tide was carried out all year round. There was a general preference for bivalves although a few gastropods were also collected. Species like *Meretrix, Paphia* sp., and *Anadara* sp. which were harvested then constitute commercially important species even today. Similarity with modern fishery size has been noticed suggesting an awareness among the coastal Harappans of the biology and the habitat of the species they had collected. Harvesting techniques were probably simple like today and mostly carried out by women and children. Meat extraction involved methods like boiling, steaming and roasting as presently employed.

Considering the molluscan contribution in the overall diet, as compared with the major food types, shellfish had a fairly insignificant role to play. Nevertheless, molluscs being easily procurable had supplemented the diet of the coastal Harappans in Gujarat with added proteins and necessary minerals.

Further, the presence in the Gujarat Harappan coastal sites of certain habitat specific species has made it plausible to suggest which were the collection areas and types of local environment. This is mostly true for edible molluscs whose collection areas were probably in the vicinity of such sites since it is difficult to transport living species over long distances. This is of relevance to sites which today are inland but were located close to the shoreline in Harappan times. Hence, at sites like Kuntasi, Lothal, Bagasra, Malvan, etc. which today are inland, the presence of estuarine and backwater species strongly indicates the proximity of tidal mud flats to these sites in the past. Furthermore collection of oysters and gastropods like *Telescopium, Terebralia palustris*, etc. suggest mangrove swamps were a part of the mud flat ecosystem.

Thus the entire Gujarat region experienced largescale molluscan utilisation during the Harappan period enhanced by its proximity to rich molluscan beds in the intertidal mud flats, estuaries and coral reef areas bordering the Gulf of Kachchh. Both shell working and shellfishing continued upto the historic period. However, more detailed examination of the coastal sites of Gujarat is essential to obtain further information on aspects like seasonality of shellfishing activities through oxygen isotope and growthline studies on shells as well as changes in the nature of shell working through time. Shells from coastal sites can also be used to reconstruct palaeo-shorelines along the Gujarat coast and to understand the shifts in exploitation patterns caused by coastal environmental changes.

Acknowledgements

I would like to thank Prof. M.K. Dhavalikar, Shri M.R. Rawal and Shri Y.M. Chitalwala for permitting me to study the shells from Kuntasi. Prof. V.H. Sonavane and Prof. V.S. Parikh from the Department of Archaeology M.S. University of Baroda very kindly permitted me to study a part of the first season's (1995-96) shell material from the Harappan site of Bagasra. Here I would also like to thank Dr. K.K. Bhan for his useful suggestions and comments. I sincerely thank Dr. V.S. Shinde for allowing me to carry out a preliminary analysis of shells from the Harappan site of Padri. Dr. P.K. Thomas and Dr. P.P. Joglekar gave me their support in my research and also helped to prepare this paper. Last but not the least I am grateful to my colleagues Matsushima and Richa, and to Shri. R.R. Dhumapurkar and Shri. S. Pradhan from Deccan College, Pune for their assistance.

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Surface Wash Processes and their Impact on Stone Age Sites

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Abstract

In semi-arid regions the erosional process of surface wash causes the removal of sedimentary cover and is responsible for the exposure of the Stone Age artefact horizons to the surface so that their post-burial and pre-re-exposure context becomes compromised by contemporary slope processes. In order to understand the nature of the impact of surface wash processes of sheet and rill erosion on exposed Acheulian artefacts on gentle or low gradient slopes, an observational study was conducted in the Hunsgi and Baichbal basins (Karnataka). This has shown that while slope angle, artefact size and location of the artefact on a planar versus a rilled surface clearly influence the rate of displacement, other factors like proximity to sediment source and the location of discard of artefacts on the slope will also determine the rate of downslope movement.

Introduction

Slope processes are mainly gravity induced movements which assisted by water cause the erosion, transport and deposition of sediments from a higher to a lower relief. Movement of sediments on slopes takes place in the form of flows, slides, wash and creep. By conducting experimental studies as well as by examination and analysis of sediments and artefact assemblages recovered from slope contexts, both geomorphologists (Young 1960, 1972; Kirkby 1969; Schumm 1967; Carson and Kirkby 1972; Schumm and Mosely 1973; Caine 1981; Abrahams 1986; Bell and Boardman 1992) and archaeologists (Rick 1976; Fuchs *et al.* 1977; Butzer 1974, 1982; Frostick and Reid 1983; Paddayya 1983, 1987; Hivernal and Hodder 1984; Schuldenrein 1986, Petraglia and Nash 1987; Wandsnider 1987, 1989) have attempted to assess the impact of slope processes on sediment behaviour as well as on the formation and conservation of the archaeological record.

In the Hunsgi and Baichbal basins (Gulbarga District, Karnataka) the majority of the Acheulian sites have been found to occur on or near the surface on a gently sloping topography where the average slope angle is less than 3° (Paddayya 1982, 1991). The principle soil sediments which cap the artefact horizons, are black soil sediments, which have a high proportion of silt and clay. These sediments are today rarely thicker than 100 cm and usually range in thickness from 0-30 cm. The contemporary degrading process of erosion which operates predominantly under the influence of sheet-wash and rill erosion is responsible for removing the sediment cover and exhuming the artefacts to the surface and subsequently causing their down slope transport. Following the principle of the uniformitarian nature of geomorphic processes one can assume that slope processes similar to contemporary processes were operative on the sites in the past as well. This can also be surmised from the fact that Acheulian artefacts in the region have been found in a secondary context within colluvial deposits and are also capped by sediments which are essentially deposited by slope processes (Paddayya and Petraglia 1993). The thin (0-30 cm) and unstratified nature of Acheulian artefact horizons under the sedimentary cover again point towards the fact that the rates of sedimentation were slow in the past and therefore the artefacts must have been exposed to the surface for some time before their final burial. Thus despite the low gradient surface and slow rate of site sedimentation the artefact assemblage may have been structured to some extent by the slope processes prior to its burial.

The fundamental problem while getting reliable behavioural information from these sites concerns how these sites have been structured by past and present slope processes of gravity and surface wash. Since in the majority of the site contexts there is no evidence from associated sedimentary deposits as to how a site may have been modified during the process of sedimentation which caused its burial and re-exposure, the author felt that there was a need to evaluate the impact of these processes on low angled slopes. Thus an observational study on the artefact behaviour occurring on exposed surfaces was undertaken.

The Nature and Impact of Surface Wash Processes — a Review

Surface wash is a seasonal process and is the chief process responsible for erosion on slopes in semi-arid regions (Kirkby 1969; Vaidyanathan 1964). Surface wash includes the sub-processes of raindrop impact and surface flow. Surface flows cause sheet erosion, rill erosion and gully erosion. Rates of surface wash vary widely dependent as they are on the intensity of rainfall as well as on the presence/absence of vegetation cover, soil erodibility, slope angle and slope length (Meyer 1986; Young and Saunders 1986).

Sheet erosion takes place in the inter-rill areas where a uniform layer of soil is removed by splash and raindrop impact and is transported by a thin film of runoff (Meyer 1986). In these inter-rill areas a relatively uniform removal of soil takes place, as the flows are not concentrated. Erosive sheet flows are inherently unstable (Horton 1945) and tend to evolve into rills. Rills develop where runoff concentrates in furrows made by tillage implements or in gentle depressions and irregularities on the land surface. However rill erosion does not begin until the flow's erosiveness exceeds the soil's ability to resist detachment. Thus rilling starts only a considerable distance downslope. Rill erosion leads not only to the exposure of the underlying surfaces but also to the transformation of the exposed surfaces by the formation of gullies and badland topography.

The rills dissect artefact horizons and are responsible for their partial exposure. In the long term, continuous sheet or rill erosion causes the exposure of artefact horizons where fine-grained sediments are completely removed and the area is characterised by an abundance of surficial gravel along with the artefacts. The impact of surface wash process results in the removal of the finer fraction of the sediments and leaves behind the artefacts and unconsolidated, coarser fraction of the sediment as lag deposits. After their re-exposure in some cases the artefacts and the gravel are transported downslope and are redeposited in a secondary context.

Studies have shown that surface wash processes influence sediment/artefact movement, selectively sort sediments/artefacts by size and shape, and align the sediments/artefacts preferentially. Other than precipitation the variables which influence the rate of artefact/sediment movement, their orientation as well as the nature of size sorting, are the degree of slope, vegetation cover, topographic variation, nature of substrate and the shape and weight of the artefact.

Rate of Artefact Movement

The downslope displacement of particles is a function of stress and time. The quantity and size of material that can be transported by runoff is a function of runoff velocity and turbulence, which increases as the slope steepens and as the depth of the flow increases (Meyer 1986). Therefore degree of slope determines the force of gravity which in turn determines the rate of down slope movement of the sediments. Thus on steeper slopes there is greater movement as compared to the gentler slopes. S.A. Schumm studied surficial rock creep on slopes in Western Colorado in the United States. His studies show that rates of surficial rock creep range from a few mm per year on a 3° slope to almost 70 mm per year on a 40° slope. He also observed that rates of rock creep "... vary with natural variation in soil characteristics and microclimate as well as accidental disturbance ..." Schumm (1967: 560).

Frostick and Reid (1983) conducted experiments on an un-vegetated slope of 30.7° at the Koobi-Fora escarpment in Kenya. After two years and four rainy seasons they found that 98% of the artefacts and 88% of fossil bones remained within 2 m of their original position. Their study showed that material placed in rills underwent greater displacement as compared to the material lying on a planar surface. They observed that the median displacement of basalt pebbles on a planar surface was 0.82 m per year while the pebbles in the chute/rills had a median displacement value of 3.5 m per year. In their experimental studies they also investigated the role of particle shape on the rate of movement. They found that objects with greater sphericity underwent greater displacements. They however felt that even though the sphericity of a particle plays an important role in its rate of displacement, it was mainly particle mass and slope angle, which determines the magnitude of the sheer force acting on the particles occurring on slopes. Poesen also made similar observation in his experimental study in the Belgium loam region (Poesen 1987).

The rate of movement of artefacts under the impact of sheet-wash is also available from experimental studies done by Petraglia and Nash (1987) at the Jemez Canyon in New Mexico, U.S A. At one of their experimental stations set up on a 6° (slope they found that gravity combined with sheet-wash caused a mean down slope movement from 3.5 cm per artefact at the end of six months to 7.3 cm after 1 year and 13.3 cm after 2 years.

Though related to aeolian processes Wandsnider's (1989) experimental studies in dune contexts, indicated that the nature of substrate also determined the rate of movement where the rate of displacements were higher on indurated beds as compared to sandy substrates.

Vegetation also plays an important role and all experimental and observational studies have pointed towards its role in retarding the rate of downslope movement (Rick 1976; Paddayya 1983, 1987).

Size Sorting

Like other geomorphic processes, slope processes are also known to selectively sort artefacts by size. Rick (1976) while inspecting the spatial distribution of artefacts on a moderate angle slope (10-40°) at a Preceramic site in highland Peru found that gravity promoted the down slope movement of heavier artefacts, while the lighter artefacts continued to remain on the upper slopes. However in Israel, Fuchs and associates could not find any evidence of size sorting on the slopes of open air Epi-Paleolithic sites (Fuchs *et al.* 1977). In Oaxaca, Flannery (1976) noticed size sorting on the slopes under the impact of sheet erosion. His observations showed that here the lighter artefacts tended to move farther than the heavier ones unlike the predominantly gravity induced size sorting in the highlands of Peru. Frostick and Reid (1983) also found that on slopes of 30° larger and heavier artefacts had the greatest transport rates, while on slopes of 10° larger material remained unmoved by slope-wash processes Petraglia and Nash (1987) observed at their experimental station that on a slope inclined at 6°, the heavier artefacts remained stationary as compared to the lighter ones.

These studies show that on moderate slopes if gravity is the sole operating agent then larger artefacts will undergo greater displacements. On low angled slopes however, it is the lighter ones that will undergo greater displacement.

Artefact Orientation

Butzer's observational study at Alexandersfontein in South Africa documents the nature of orientation of artefacts, which have been influenced by sheet-wash processes (Butzer 1982). Here he documented two naturally exposed clusters of Middle Stone Age artefacts. His study showed that while the dips were mainly down slope, the artefact orientations deviated 14° to 20° from the mean slope direction. He observed that the deviations were largely a result of micro topographic variations. Secondly, he observed that rainfall could also create clusters with apparently random orientation.

Description of the Study

In this study the combined impact of surface wash and gravitational forces on the rate of artefact displacement as well as on the production of spatial patterns (including size sorting) has been investigated. Due to limitations of time and resources instead of setting up an experimental plot, artefacts on the naturally exposed surface of two Acheulian sites (Fatehpur-VIII and Yediapur-IV) in the Baichbal basin were monitored. Thus there was no control on the placement of artefacts in relation to their size. However one advantage of this was that the biases which creep into readings during the settling-in period were avoided. As suggested by Caine (1981), in short-term experimental studies it is preferable that particles are marked in situ given the settling period taken by the introduced particles, where the rate of movement of the introduced particles is higher than the natural rate of similar particles on the site. His studies on the slopes in Tasmania, spaning from 1965 to 1979, showed that on low-angled slopes the settling period is about 1 year before the rate of movement, are representative of natural processes.

The observational locations were chosen in order to determine the role of two variables — slope and minor topographic variations — on artefact behaviour. The objective was to have better control on their impact without interference from tillage activities. Thus the choice of observational plots was also determined by the fact that these sites were located on uncultivated slopes. The artefacts were mapped and plotted, and attributes like size (length, breadth and thickness) and long axes orientation were recorded. To facilitate identification the artefacts were marked by a number written on them in waterproof ink. In order to ensure that the ink would not fade the numbers were re-written every time recording was done. Secondly, artefact type and raw material were also recorded to ensure identification. The extent of displacement was always recorded from its original location.

Other than topographic factors, the amount, duration and intensity of rainfall also control the rate of surface wash. However, rainfall data for the years 1992 and 1993 (the years in which the study was conducted) were not available. Data of the previous 15 years shows that the average annual rainfall recorded for the nearest station of Kembhavi is 584 mm where the rainfall is concentrated mainly in the monsoon months (June to September). The mean monthly average of these four months ranges from 100 to 155 mm. The rest of the year is usually dry with rainfall ranging up to 55 mm. Short duration but high intensity thunderstorms are common in the pre-monsoon months. Figure 1 shows the rainfall distribution of the years 1989-1990 as well as the mean of the previous 15 years.

Location 1 (Fatehpur-VIII)

Fatehpur-VIII occurs on a weathered pegmatite ridge on the right bank of Fatehpur stream (Fig. 2) in the Baichbal

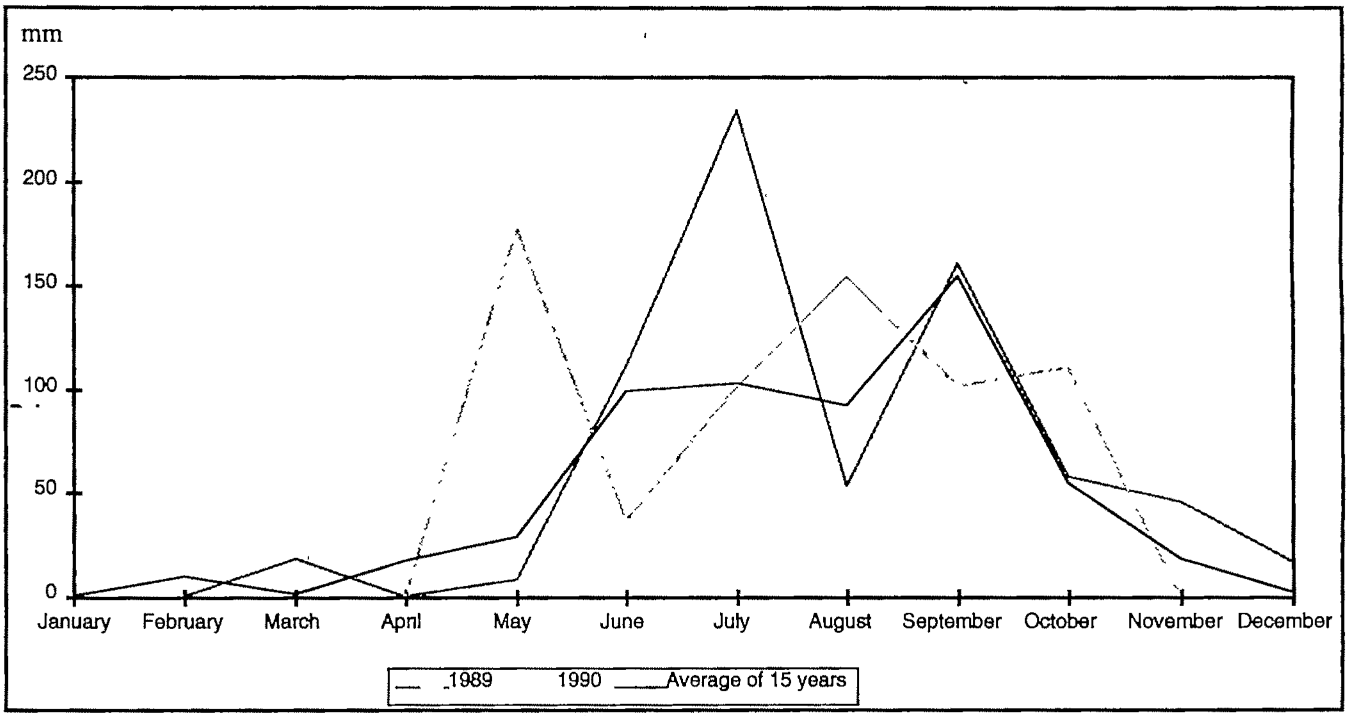

Fig. 1: Mean monthly rainfall (mm) recorded at Kembhavi station

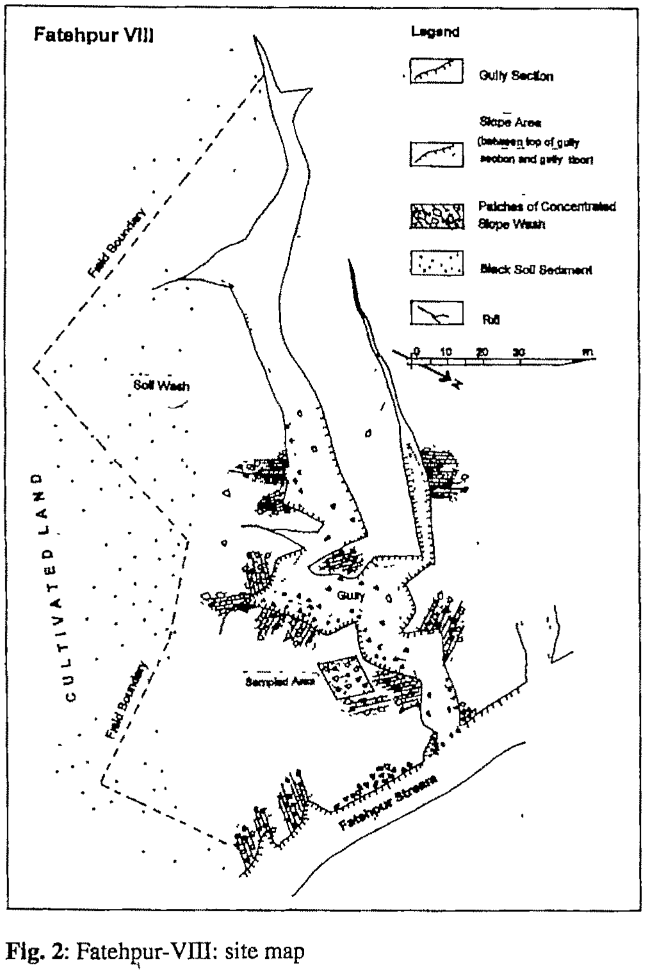

Fig. 2: Fatehpur-VIII: site map

basin. The ridge gently slopes to the stream bed and at its maximum height is about 150 cm above the bed. This is an uncultivated barren patch with almost no soil cover. Here the artefacts are exposed to the surface and occur in an area, which extends for 150 m in an east-west direction and 100 m in a north-south direction. The site is cut by an erosional gully which has a maximum depth of 1 m. Here large portions of the artefact assemblage have already been influenced by the process of sheet-wash. The impact of ongoing sheet-wash processes is evident from the absence of fine sediments and the presence of patches of colluvial gravel which consist chiefly of artefacts, manuports, and weathered bedrock pieces, some of which can be seen sliding down gully walls and into the stream and some of which are embedded within the colluvial gravels in small pockets (Fig. 2).

A sample area of 10x10 m on a 3-5°, predominantly north facing slope, was isolated on the right side of the gully which cuts the site in a roughly southwest-northeast direction (Fig. 3). This patch is free of rills and is therefore affected only by sheet flow. At a distance of approximately 2 m on its eastern/northeastern edge is the Fatehpur stream bank while on the northern end of the sample area at a distance of 25-120 cm the edge of the gully slope begins. Here 38 artefacts were plotted along with weathered rock fragments as they naturally occur. The artefacts included mostly finished tools, flakes and utilised pieces made on granite-gneiss, chert, schist, quartzite and dolerite The site was monitored from 20 Jan 1992 to 8

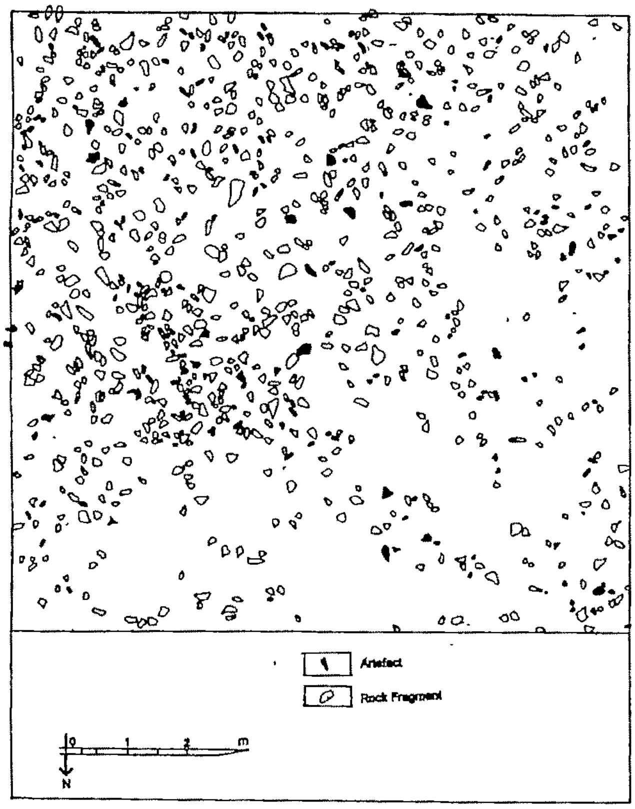

Fig. 3: Fatehpur-VIII: location of artefatcs and gravel at the beginning of the study

December 1993 during which observations were made on four occasions.

Artefact recovery

Of the thirty-eight artefacts which were plotted, three (7.89%) were not recorded at all; one (2.63%) was recorded only once; two (5.26%) were recorded twice, four (10.52%) were recorded thrice and twenty-eight (73.68%) were recorded all four times. The three artefacts, which were never recorded after they were initially plotted, were less than 2 cm in size. The artefact which was located only once was 13 cm long and was found lying upslope where it was in all probability dislodged by humans.The two artefacts which were recorded only twice were less than 6 cm long and could not be located in the succeeding collections. Four artefacts, recorded thrice, ranged from 7 to 11 cm in length. Of these, three artefacts could not be located later and one was found on the other side of the gully which indicates that it was transported by humans.

Artefact mobility

After marking out the site on 20 January 1992 it was monitored only at the end of the year on 6 December 1992. During this span of approximately 11 months the average movement undergone by thirty-five artefacts was 3.57 cm. After approximately three months on 27 February 1993 the plot was again inspected, and average movement of the artefacts from their original location was 3.91 cm, i.e. only a marginal increase of 0.34 cm in the average movement of the artefacts. Again in the month of June 1992 the artefacts were plotted after a spell of heavy rainfall at the beginning of the monsoon season. The average movement by a total of thirty-two artefacts was 4.99 cm. The last observation was made in December 1993. At the end of almost two years (23 months) and after two monsoon seasons, on an average the artefacts had undergone a down slope displacement of 8.25 cm (Table 1).

The mean displacement undergone by each artefact for the number of times it was recorded was also calculated (Fig. 4). At the end of two years in the case of the majority of the artefacts (21) this was equal to or less than 5 cm. Eleven artefacts had mean displacement values which fell between 5 and 10 cm and three artefacts had mean displacement values between 10 and 15 cm. The maximum and minimum mean displacement undergone by the artefacts was by 20 cm and 1 cm respectively (Table 1).

Table 1: Fatehpur-VIII: collection-wise displacement data of artefacts

Observation Period/Date of Collection	**n**	**Min**	**Max**	**Median**	**Mean**	**Standard Deviation**
1. After 10 months 16 days (6.12.92)	35	0	12	2	3.57	3.73
2. After 13 months 7 days (27.2.93)	34	0	14	3	3.91	3.95
3. After 16 months 24 days (14.6.93)	32	0	14	4	4.99	3.69
4. After 23 months (8.12.93)	28	1	20	5.5	8.25	4.24

n = number of artefacts
measurements in centimetres

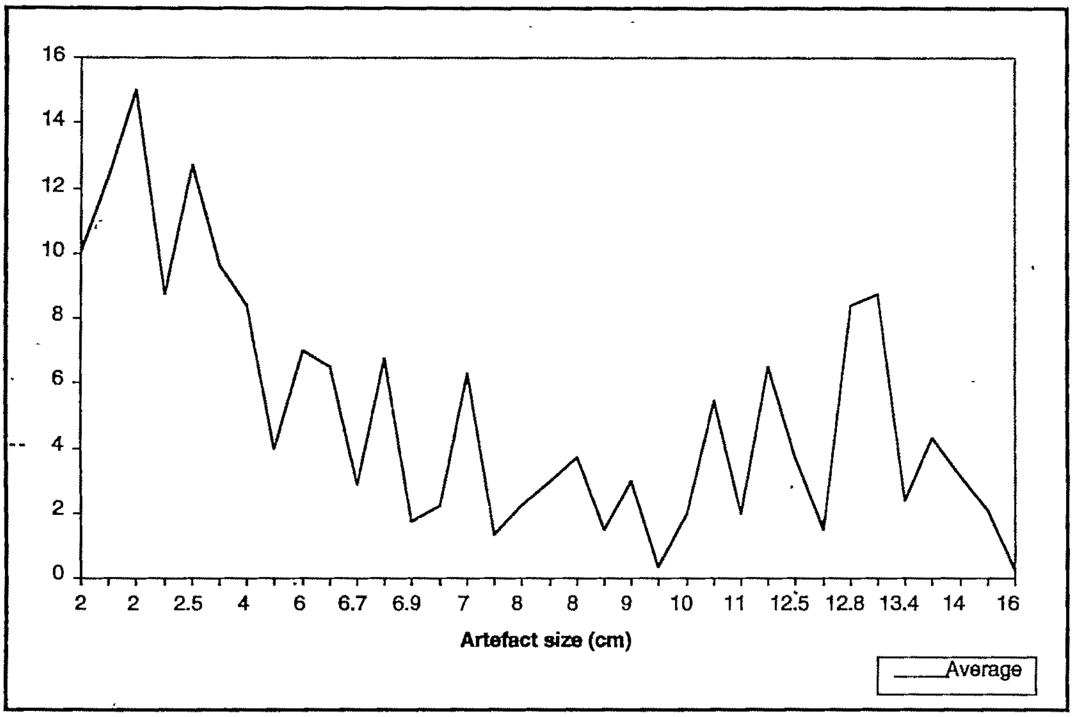

Fig. 4: Fatehpur-VIII: size-wise mean displacement of each artefact

From the observations it is clear that the seasonal rains determined the amount of movement of the artefacts. During the post-monsoon period movement was negligible (0.34 cm), whereas it had almost doubled after the second monsoon which was probably a result of heavy rainfall. However disturbance by humans and animals cannot be ruled out. The rate of artefact movement must have also been determined by the location of the site on the lowermost portion of the interfluve near the stream bank. The overland flow from the interfluves must have increased in its turbulence and flow depth by the time it reached downslope thereby causing displacement of artefacts. Secondly it was noticed that artefacts which were surrounded by dense gravel and weathered bedrock fragments underwent limited displacement. Thirdly, after the first two spells of rainfall of the second season, in the month of June in 1993, it was observed that the finer gravels showed a tendency to cluster and arrange themselves in small arch-like shapes measuring 10-30 cm in length and with a maximum breadth of 2-5 cm. Either clumps of grass roots or larger gravel pieces acted as bulwarks against which other sediments transported from up slope collected thereby forming arched shapes similar to the transverse bars in a stream channel. These arches further stabilised when grasses grew on them and inhibited the down slope movement of the artefacts.

Size sorting

The size of the artefacts found in the observational plot ranged between 1-16 cm in length, 0.5-11.2 cm in breadth and 0.1-5 cm in thickness. Based on the maximum dimension (length) they were grouped into three classes. Class-wise average movement of artefacts is given in Table 2. The table clearly shows that the average movement undergone by the smaller artefacts has been consistently higher than that undergone by the other two classes in all the four observations. This indicates that under the effect of surface wash smaller artefacts tend to undergo greater displacement than larger artefacts. This behaviour is consistent with the geomorphic observation that at any given rainfall intensity the distance of movement decreases with increasing particle size (Kirkby 1969). However, smaller artefacts did show a tendency to get covered by coarse gravel or, as also observed by Petraglia and Nash (1987), they get hidden below larger cobbles which prevent their movement.

Figure 4 also shows the variability in the mean displacement in each size class. It was observed that artefacts, which were located downslope, underwent greater displacement as compared to the artefacts located on the upper part of the slope. Two explanations can be given for this observation. Firstly, the density of the gravel in the upper part of the slopes is much higher and this probably restricted the movement of the artefacts. Secondly, since the depth of flow progressively increases down slope (Horton 1945), one can expect that the increased depth of the flow caused sufficient stress resulting in greater displacement rates for the artefacts located down slope. This observation is further attested to by the fact that the density of gravels is much greater in the upper part of the slopes as compared to the lower part (Fig. 3).

Artefact orientation

The long-axes of the artefacts were found to be oriented both transverse and parallel to the slope in each collection. In order to check for the general orientation of the gravel about 200 random measurements were taken on the gravels each time collections were made. The average of the four observations showed that 42.6% of the gravel was oriented with the long-axis parallel to the slope, with deviations ranging from 0-15° from the slope angle. Studies by geomorphologists have shown that talus/scree moves down slope by shearing parallel to the slope, where the long axis is pointed down slope in a position of least resistance (Davison 1888; King 1966). However, resistance provided by the ground surface as well as obstructions in the form of gravels promote the transverse alignment of the artefacts and gravels.

Location 2 (Yediapur-IV)

Yediapur-IV is located about 3 km southeast of Fatehpur-VIII and lies to the left of the Yediapur-Mudnur road (Fig. 5). This site is also located on a pegmatite ridge, which has been cut by a gully. Cultivated fields flank both sides of the site. The site covers about 200 m northsouth and 100 m eastwest. Here the artefacts occur on (1) bare bedrock, (2) under sedimentary cover, and (3) can also be seen eroding out of the sedimentary cover. This site has several topographic variations including flat patches of exposed bedrock and a gully as well as rills on the slopes which flank the gully.

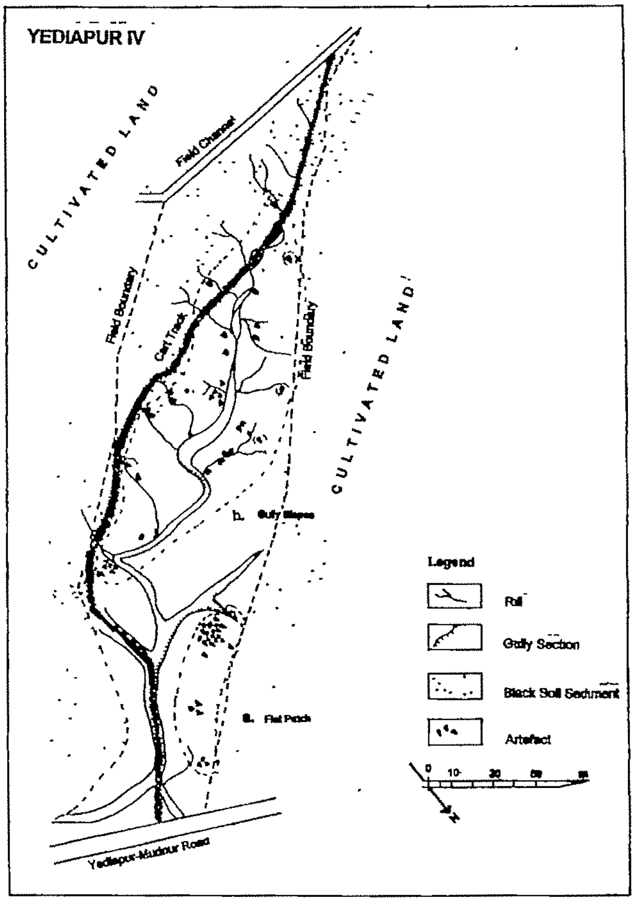

Fig. 5: Yediapur IV: site map

On the northern edge of the site to the left of the gully is a flat patch of bedrock, with a negligible slope, where artefacts and gravel are exposed to the surface. Twenty seven artefacts were plotted in this area. The artefacts are comprised mostly of complete tools and debitage made on granite-gneiss, dolerite and chert. Their dimensions ranged between 2.5-21 cm in length and 1.5-11 cm in breadth and 0.8-7 cm in thickness.

Table 2: Fatehpur-VIII: size-wise mean displacement of artefacts in the four collections

Size Class	**Collection Number**							
	1		**2**		**3**		**4**	
	n	$\bar{X}$	n	$\bar{X}$	n	$\bar{X}$	n	$\bar{X}$
0-6 cm	9	8.66	9	9.11	7	10.76	7	13.43
6.1-12 cm	17	2.24	17	2.30	17	3.82	13	6.03
12-18 cm	9	1.0	8	1.5	8	2.44	8	4.03

$\bar{X}$ = mean displacement (in cm)
n = number of artefacts

The slopes (gradient varies from 2 to 6°) which flank the gully consist of weathered bedrock covered by soil wash derived from upslope. Out of the 32 artefacts, 8 were found in the rills which cut the slopes at several places and 26 were found in the inter-rill areas. Their dimensions ranged from 4.5-18 cm in length, 3-12 cm in breadth and 0.5-6 cm in thickness. The exposed artefacts included mainly complete tools and a few debitage pieces fashioned chiefly on limestone and dolerite. The site was observed during the period of 9 December 1992 to 16 December 1993 during which time three recordings were made.

Artefact mobility

At the end of one year, on the flat patch of pegmatite bedrock two artefacts were missing and the average mobility of the 25 artefacts including the smallest artefact (2.5 cm long) was almost nil (0.8 cm). This clearly shows that absence of a slope discouraged artefact movement. In all three observations the artefacts were found to be exactly in the same position in which they were first found.

On the slopes of the gully, out of the 32 artefacts 13 were missing at the end of the year, 12 from the inter-rill area and 1 from the rill area. Predictably the mean disturbance undergone by the artefacts in the rill was a little more than twice that of those located in the inter-rill area (Table 3).

The mean movement of each artefact also indicates that the displacement undergone by artefacts in the rill was higher (Fig. 6). In the inter-rill areas one of the main factors which contributed to the limited movement of the artefacts was that several of them (especially those located on the upper part of the slope) occurred on clayey sediment, which on getting wet showed a tendency to expand and enclose the artefact thus restricting its downslope displacement.

Artefact orientation

Artefacts from the flat patch of land did not show any preferred orientation in all three recordings. But on the slopes of the gully the long axes of several artefacts were seen to be aligned in the direction of the slope of either the rills or the gully.

Other observations

A large number of the artefacts, which could not be traced were those which were originally found on the upper part of the gully slopes. Since soil sediments have been observed to be creeping down slope from the cultivated lands it is probable that the artefacts were covered by sediment and thus could not be recovered. A few artefacts were found clustered near a bush, the roots of which had been exposed by a rill. They were found wedged within the roots and also fallen within the crevices formed by the roots in the heavily weathered bedrock.

Conclusion

These observations have brought to light several points. Firstly, they show that under the impact of surface wash smaller artefacts tend to undergo greater displacement than larger artefacts. However, displacement is also subject to the location of particles on the slope where artefacts abandoned on the lower parts of slopes will undergo greater displacement as compared to those discarded on the upper part of the slope. Secondly, artefacts also show a tendency to get covered up either by fine sediment derived from upslope or by coarse sediments and gravels derived from the weathering of the bedrock, which either stops or retards their downslope displacement. Thirdly, under the impact of sheet-wash and rill erosion even on gentle slopes the artefacts and colluvium will show a tendency to be oriented parallel to the slope direction. However since the ground surface is usually uneven the overall orientation

Table 3: Yediapur IV: collection-wise mean displacement of artefacts occurring on flat patch of land and on the gully slopes

Observation Period/Collection Date	**Flat Patch**		**Gully Slopes**			
			Inter-rill		**Rill**	
	n	**Mean (cm)**	**n**	**Mean (cm)**	**n**	**Mean (cm)**
1. After 2 months and 15 days (24.2.93)	25	Nil	18	0.33	8	0.94
2. After 6 months and 7 days (15.6.93)	25	Nil	15	0.86	8	1.86
3. After 12 months and 7 days (16.12.93)	25	0.8	12	1.66	7	3.67

n = number of artefacts

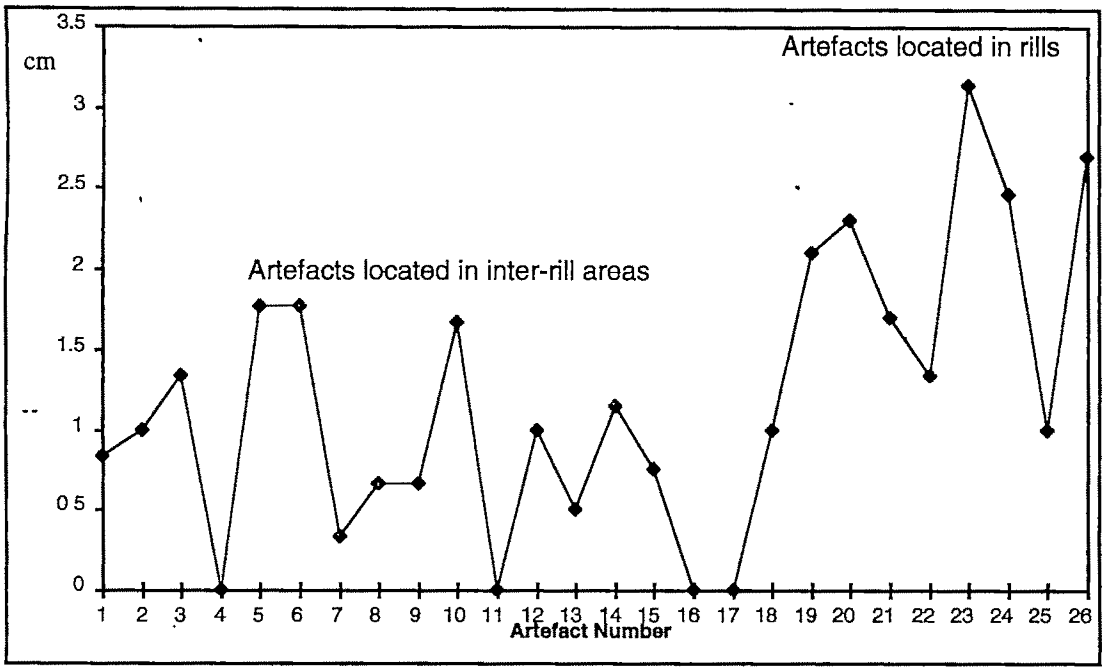

Fig. 6: Yediapur IV· mean displacement (cm) of each artefact located on the slopes of the gully

pattern may not always be directed towards the main slope. Thus orientation angles may not always be a useful indicator for the assessment of slope-wash processes. Fourthly, artificial clustering may occur where there are obstructions in the form of bushes and gravel pile ups. Lastly, artefacts will not undergo any significant displacement where the site occurs on flat topography. However, in such contexts one can expect smaller chips and pieces of micro debitage to undergo transport by raindrop impact as well as by sheet-wash erosion. This feature could not be demonstrated in the field, though it has been observed by geomorphologists that even though the net rate of downslope transport by splash is usually very small, raindrop impact can cause 4 mm stones to move a distance of upto 20 cm, 2 mm stones upto 40 cm and smaller ones upto 150 cm (Kirkby 1969) in a random direction. Secondly, small particles can undergo greater displacements if they are splashed by raindrop impact into nearby rills or gullies from where concentrated runoff transports them further downslope (Meyer 1986). Thus one can expect that the sites which have been exposed to slope processes of sheet-wash and rill erosion for a longer time will certainly be depleted of their smaller artefact components. Given the variability in artefact behaviour, in the study of archaeological assemblages recovered from low angled slopes one has to understand the microtopographic variations within the site in order to have a better understanding of how slope processes have re-structured an assemblage.

To conclude, it may be pointed out that, though experimental studies have given us clues regarding the expected nature of artefact behaviour on low angled slopes in semi-arid regions, long-term experimental work needs to be undertaken to understand how low energy overland flows operate and cause the erosion and burial of artefacts found on the surface of soft sediments as well as on a hard substrate like bedrock. More importantly long-term actualistic studies must be undertaken to understand and relate the influence of these processes on the structure of the assemblage produced during and after discard by hunter-gatherer groups during episodic use, seasonal use, seasonal re-use as well as long-term continuous use of a site. It is only then that more meaningful and objective criteria can be derived to assess behavioural processes from sites which have been influenced by both ancient and contemporary slope processes.

Acknowledgements

The present study was carried out as a part of my doctoral research, which was supported by a fellowship given by the University Grants Commission. I would like to thank Aletha Tavares, Bishnupriya Basak and Suchi Dayal for the valuable help extended by them in documenting and recording the observational plots.

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Archaeology of the South Arcot Region with Special Reference to Megalithic Burial Complexes

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Abstract

Recent archaeological explorations have revealed different cultural traits that percolated through different geographical zones. Interestingly each zone had a distinct megalithic trait — cairn circle, urn burial and sarcophagus — and each of these three zones was occupied by a separate clan group during the Sangam period. Anthropomorphic figures and rock engravings, the first of this kind in Tamil Nadu were noticed in this region. Paintings on rock shelters reflect the pastoral economy.

Introduction

The author's recent archaeological explorations in the south Arcot region (78° 3' 47" to 80° E and 11° 1' 48" to 12° 2' 42" N: covering an area of 9700 km^2) comprising 13 talukas of Villupuram Ramasamy Padaiyatchiyar District and Cuddalore Vallalar District (hereafter South Arcot) yielded rich evidence for the existence of different cultural traits of the Megalithic as well as Early Historic period (Fig. 1).

Besides anthropomorphic figures, sites yielding petrographs and petroglyphs were noticed. The rock engravings found at Perumukkal are the first of their kind in Tamil Nadu. As a sequence to the evolution of the rock art in the western part of the region are memorial stones with *vatteluttu* script on the theme of cattle raids. The Early Historical period is marked by the occurrence of Punch-marked coins, Roman coins, coins of Malayaman (the Sangam Age chieftain), Tamil-Brahmi inscriptions - all further supported by habitation mounds. Thus the region under review appears as a buffer zone where various cultural traits percolated through different geographical areas. The major part of this region known in the Historical period as *nadu-naadu* conveys the meaning of territorial division, *naadu* lies at the centre *nadu* (Fig. 2).

Megalithic Culture

J.H. Garstin in 1876 made the first discoveries in this region at Kollur and Devanur (Garstin 1876). Since then explorations carried out over the years, have revealed a number of megaliths located over almost the entire region thereby throwing much light on the various aspects of the Megalithic culture. Nearly 175 archaeological sites have been recorded of which 143 are Megalithic (Table 1-3). More than a hundred burial sites were brought to light during the present exploration alone. There are 24 sites yielding cairn circles, 11 sites with stone circles, 1 site with a dolmenoid cist, 86 sites with urn burials and 12 sites with sarcophagi. Each type is distributed within a specific geographical zone of this region. This is a tentative list as the cist burials mostly had either urns or sarcophagi but usually the latter variety. Urn burials and sarcophagi without any lithic appendage are also included in the category of megaliths as these were placed in stone circles, dolmens, cists, and cairn circles in the upper region of this district. However, one should emphasise here that the urns without any lithic appendage are developed locally as an independent cultural trait.

Spatial Distributional Pattern

Unlike in other parts of Tamil Nadu, the present study area shows the dominance of three distinct megalithic traits confined interestingly to three separate geographical zones (Fig. 3). The first, which is related to the cairn circle category entered the western part of this region from Dharmapuri District along the river Pennaiyar through the

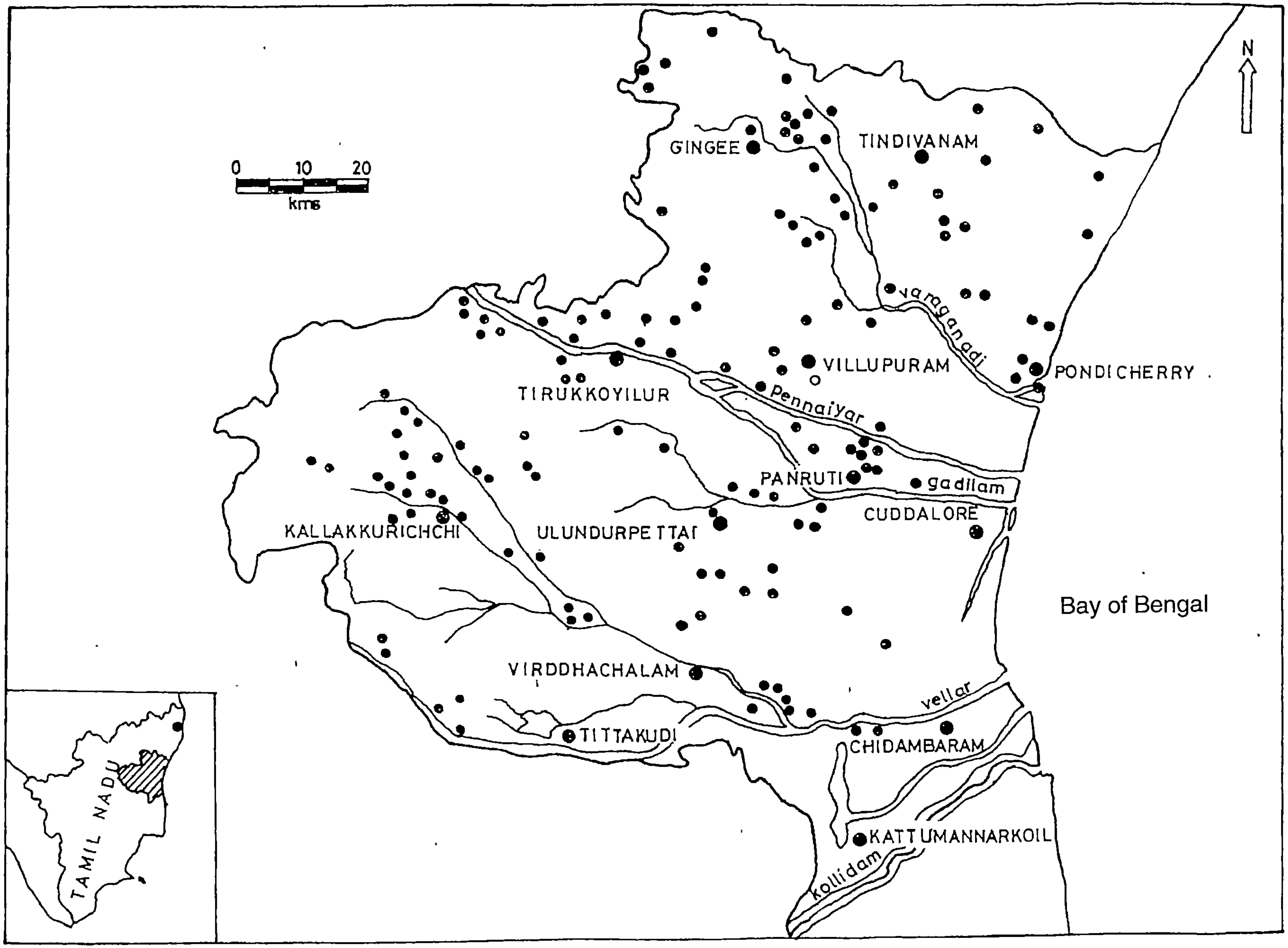

Fig. 1: Archaeological sites in the south Arcot region

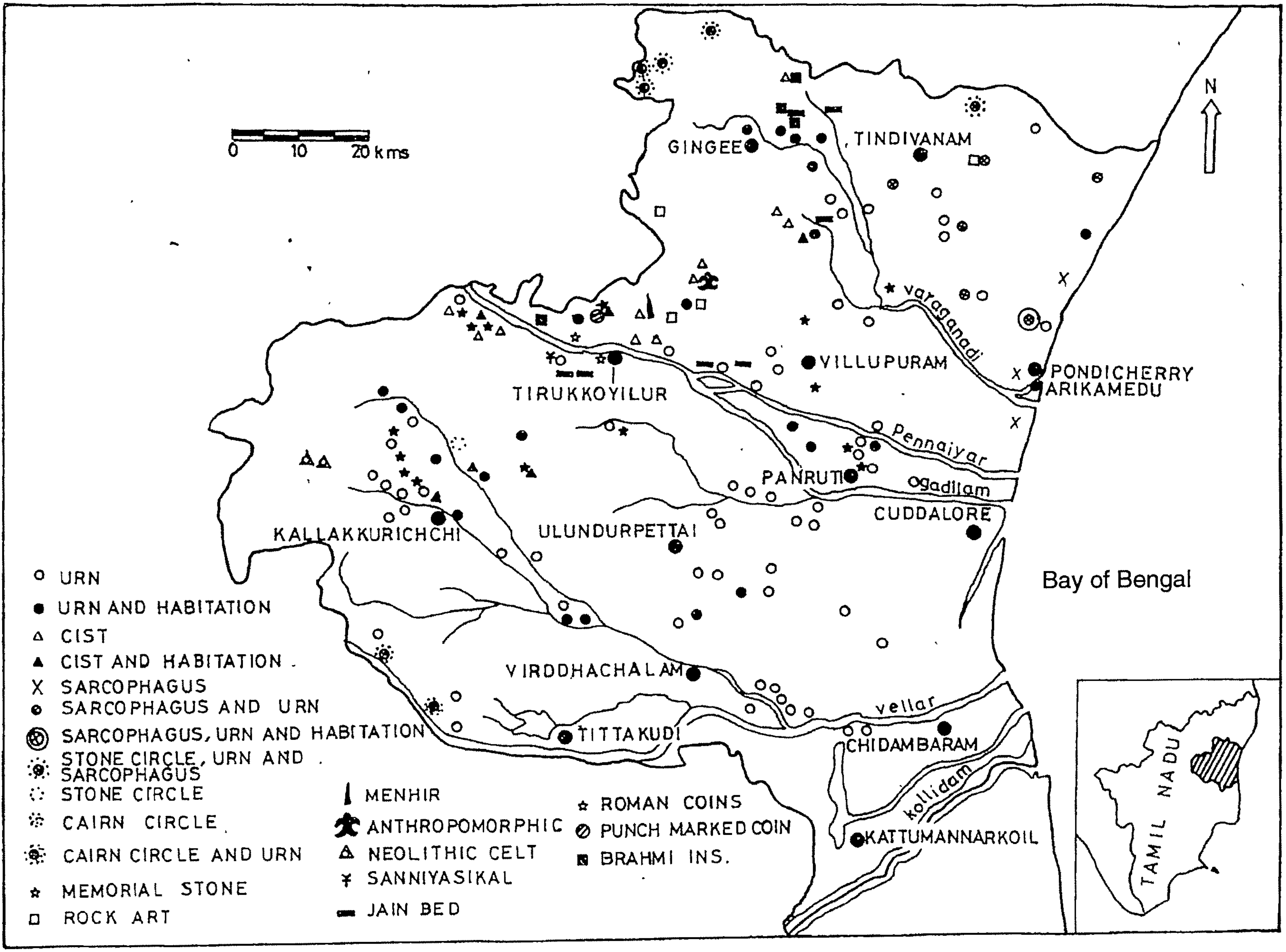

Fig. 2: Location of archaeological sites from the Neolithic to the Early Historic periods

Table 1: List of archaeological sites in Villupuram Ramasamy Padaiyatchiyar District

Site Name	Site Characteristics	Site Name	Site Characteristics
	Taluka: Gingee		**Taluka**: Kallakurichchi
Anaiyeri	CCEC	Kugaiyur	CC
Attiyur	CCEC	Kulattur (I)	CC
Thandavasamudram	CCEC	Siruvallur	CC
Varikkal	CCEC, MS	Irudaiyampattu	CCEC with round porthole on the east
Settavarai	RP, Dolmenoid cist with "U"-shaped porthole on the east	Arumbarampattu	HCBS cist with round porthole on the east, Urn Burial, Sanniyasikal
Kalaiyur	HCBS, Urns		
Marur	HCBS, MS		
Modaiyur	HCBS, Urns	Kallerikuppam	HCBS, CCEC with porthole on the east, separate urn burial complex
Perumpugai	HCBS,Urns,JB		
Rajampuliyur	HCBS, Urns		
Sandisakshi	HCBS, Urn burial, Cist with round porthole on the east	Kuttakudi	HCBS, Urns
		Pakandai	HCBS, Urns
Agalur	JB	Palapattu	HCBS, Portrait sculpture
Anattur	JB	Pallagachcheri	HCBS, Urns, Sanniyasikal
Ethanemeli	JB	Peral	HCBS, CCEC, MS, separate urn burial complex
Eyyal	JB		
Melolakkur	JB	Pottiyam	HCBS, Urns
Chittamur (Mel)	JC	Pachcheri	HHN
Gingee	JC	Kalpadai	HHM, Urns
Sirukambur	JC	Niraimathi	HHM
Dalavanur	Pallava rock-cut temple	Melsiruvalur	MS
Avalurpet	SC	Pakkam	MS
Aviyur	SC	Kondiyanattam	NC
Kappalambadi	SC	Melparigam	NC
Ariyur	SCEU or sacrophagus	Kusappadi	Sanniyasikal
Nemili	SCEU or sacrophagus	Manmalai	Sanniyasikal
Nekanur	TBI	Sadaiyampattu	Sanniyasikal
Tondur	TBI, JB and sculpture	Porasappattu	SCEC with porthole on the east
Singavaram	UBS		MS
Thayanur	Urns	Akkaraipalayam	UBS
		Arasampattu	UBS
		Eruvaypattinam	UBS
		Kongarapalayam	UBS
		Mattaparai	UBS
		Mungilthuraipattu	UBS
		Nagalur	UBS
		Parigam	UBS
		Sellampattu	UBS
		Thiyagadurgam	UBS
		Kural	Urn covered with capstone

CC: Cain circle
CCEC: Cairn circle entombing cist
HCBS: Habitation-cum-burial site
JC: Jain centre
JB: Jain bed
SC: Stone circle
SCEU: Stone circle entombing urn

SCEC: Stone circle entombing cist
HHM: Historical habitaion mound
TBI: Tamil-Brahmi inscription
UBS: Urn burial site
MS: Memorial stone
NC: Neolithic celt
RP: Rock paintings

Table 2: List of archaeological sites in Villupuram Ramasamy Padaiyatchiyar District

Site Name	Site Characteristics	Site Name	Site Characteristics
	Taluka: Tittakudi		**Taluka**: Tindivanam
Melkalpundi	HCBS, Cairn circle entombing urn burial	Kodipakkam (Vada)	Cairn and stone circle
		Mailam	CC
Tholudur	HHM	Sevur (kil)	CC
Nangurpatti	UBS	Tiruvakkarai	Cairn circle and stone
Payanappadi	UBS	Koluvari	HCBS, Urns
		Molasur	HCBS, Urns
		Nallavur	HCBS, Urn burial and sarcophagus
	Taluka: Tirukkoyilur	Uppuvelur	HHM, Terracotta figurine, celadon ware
Kottagam	193 Roman gold coins of which 12 coins had holes, one ring inlayed with semi-precious stone	Perumukkal	Rock shelter with deep
		Alagrammam	Sarcophagus
		Auroville	SC
		Kanthadu	SC
Andali	CCEC burial having porthole on the east, inside cist found sarcophagus and urns	Sittamur (Kil)	SC
		Andipalyam	UBS
		Kondamur	UBS
Devanur	CCEC burial with round porthole on the east, Menhir	Kottamangalam	UBS
		Puduppattu (Kil)	UBS
Vasanthakrishnapuram	Cairn circle with slab circle MS, Sanniyasikal, Mahisasuramardini sculpture (Pallava)	Kutteripattu	Urns
			Taluka: Ulundurpettai
Kollur	Cist	Kuvakam	Aravan fesitival
Paranur	Cist burial site	Periyapattu	HCBS, Urns
Tirukkoyilur	Excavated site yielded BRW, terracotta beads, *hukkah*, strainer, Rouletted ware and graffiti marks, Malayaman coins with Tamil-Brahmi legend	Sendamangalam	HHM, Brick structure
		Marudur	UBS
		Padur	UBS
		Senjikuppam	UBS
Adichchanur	HCBS, CCEC, Silver punch marked coins, Sanniyasikal		**Taluka**: Virddhachalam
		Anangur	MS
Gudalur	HCBS, JB, Urns, Mahavira sculpture, Vishnu and Lakshmi carved out of natural rock	Chendiyampakkam	MS
Kilvalai	HCBS, Urns, RP		**Taluka**: Villupuram
Mogalur	HCBS, Urns, Sanniyasikal	Sengamedu	Habitation mound
Nayanur	HCBS, CCEC with round porthole on the east, outer circle had stone slab	Iranji	HCBS, Urns closed with capstone
		Manakulam	HCBS, Urn burial, BRW, RSW
		Marungur	HCBS, Urns
Virapandi	HHM	Nallur	HCBS, Urn burial, BRW, RSW
Arakandanallur	JB	Palayapattinam	HCBS, Urn burial, BRW, RSW
Kiranur	JB	Puttur	HCBS, Urns
Thotti	JB	Sathapadi	Urn burial closed with lid
Alambadi	RP	Dharmanallur	UBS
Padiyandal	RP	Kurungkuppam	UBS
Mullur	SCEC burial,Urn or sarcophagus found inside the cist	Nadiapattu	UBS
		Palakollai	UBS
Jambai	TBI of Adiyaman Neduman Anji, Historical habitation mound	Peruvarappur	UBS
Edaiyur	UBS		
Sorayappattu	UBS		

Table 3: List of sites in Cuddalore Vallalar District

Site Name	Site Characteristics
	Taluka: Chidambram
Annamalainagar	UBS
Harirajapuram	UBS
Kirappalaiyam	UBS
Nanjalur	UBS
Settiya Tope	UBS
Valaiyamadevi	UBS
	Taluka: Cuddalore
Karaikadu	Excavated site
Kudikadu	Habitation mound
Kuruppampettai	HCBS, Urns, Gold piece
Cuddalore	JS
Tiruvendipuram	JS
Kurinjippadi	UBS
	Taluka: Kallakurichchi
Kurur	HCBS, Urns
Somandarkudi	HCBS, Urns, Sanniyasikal
	Taluka: Panruti
Sandavelipettai	HCBS, Urn closed with lid, Gold piece found in a urn
Maligaimedu	HCBS, Urns, Sarcophagus enclosed with capstone
Oraiyur	HCBS, Urns
Paithambadi	HCBS, Urns, Sanniyasikal
Semmedu	HCBS, Urns, Bronze objects
Aviyanur	MS
Kuchchipalayam	Sarcophagus
Kudiruppu	Urn burial enclosed with laterite blocks
Kandarakottai	UBS
Marungur	UBS
Meliruppu	UBS
Vadakuttu	UBS
	Taluka: Virddhachalam
Udaiyarnattam	Anthropomorphic placed in the cairn circle
Ariyur	HCBS, Urns
Kalpattu	HCBS, Urns, Durga bas relief sculpture (Pallava), JB
Kappur	HCBS, Urns
Karuvakshi	HCBS, Cairn circle cist burial, Cist had a hole on the east, Sarcophagus placed inside the cist, JB
Kodukkur	HCBS, Urns and sarcophagus
Kunnattur	HCBS, Cairn circle, Urn burial
Perumbakkam	HCBS, Urns
Tiruvamattur	HCBS, Rouletted ware
Brahmadesam	HHM
Esalam	HHM
Arasalapuram	JB
Ennaiyiram	JS
Gudalur (Mel)	JS
Mandagapattu	Pallava rock-cut temple
Panamalai	Pallava temple with painting
Kallikottai	UBS
Kuchchipalayam	UBS
Panapakkam	UBS
	Taluka: Villupuram
Viradikuppam	UBS
	Taluka: Tindivanam
Vanur	Sarcophagus

Chengam pass. This variety is mainly concentrated in the hilly tracts. The stone circle without any cairn packing is, in fact, only a degenerate form of the cairn circle. The second type — the urn variety — is predominantly noticed in the eastern part of the region particularly south of the river Pennaiyar. Its widespread existence in the deltaic area of the rivers Kaveri and Vellar clearly indicates its indigenous nature. The third trait, consisting of sarcophagus burials, like the urns, are indigenous and mainly found north of the Pennaiyar River, predominantly in the non-deltaic region of this district.

These three traits were superimposed in the area of contact. The concentration of cairn circles enclosing a cist with a round porthole on the east were observed in the western part of this region particularly in the Kallakurichchi and Tirukkoyilur talukas. These upland hilly tracts during the Sangam period were controlled by a clan called Malaiyamans with their capital at Kovalur (Tirukkoyilur). This area is drained by the rivers Pennaiyar, Vellar and Gomuki, and so it had a wide open pass- the Chengam on its western border, the cultural traits naturally were often influenced from the west. The distribution of cairn circles with cists is concentrated in the zone between

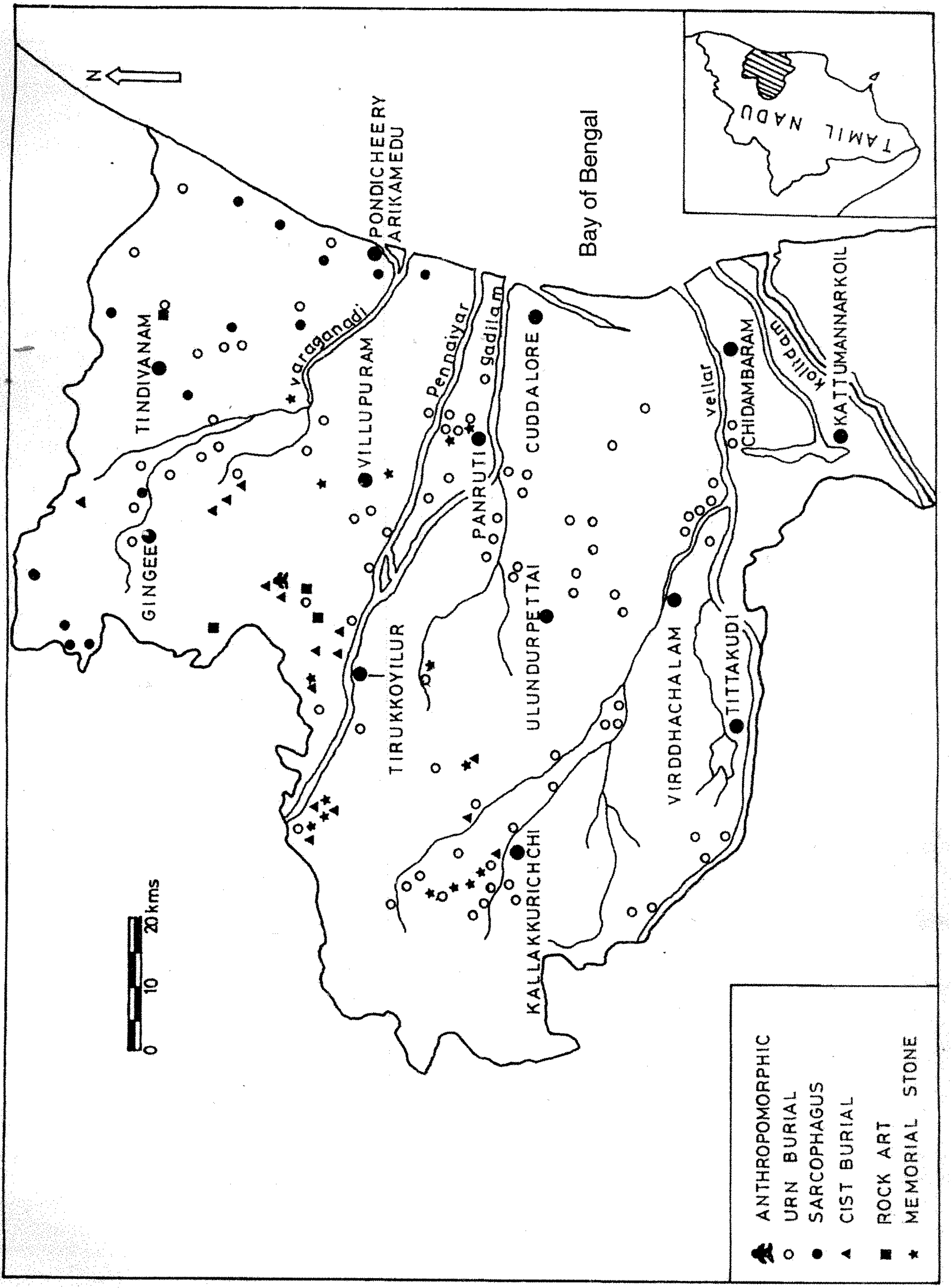

Fig. 3: Megalithic sites in the south Arcot region

200-500 AMSL. Once the river reaches the plain (below 200 AMSL) the concentration of cairn circles is drastically reduced. For instance, the talukas of Kattumannar koil, Chidambaram, Cuddalore, Panruti, Tindivanam, Virdhachchalam and the eastern part of Tittakudi all of which occupy the eastern part of this region fail to yield any Megalithic evidence.

The stone circles which are degenerate forms of the cairn circle, were found north of the river Varahanadi (Tindivanam and Gingee talukas). These stone circles invariably contained within them an urn or sarcophagus depending on the external contact.

Distributional pattern

Observations made at selected sites comprising about 200 burials of different types yielded clues as to the distribution pattern within a complex. When a site contained more than one type of burial, each type occupied a separate portion of the complex. Fine examples were seen at Kallerikuppam and Peral in Kallakurichchi taluka where the cist burial and urn burial complex occupied separate areas. Likewise at Andali (Tirukkoyilur taluka), the sarcophagus and urn burial complexes occupied different areas thereby suggesting that two different groups living in a particular village had their individual graveyards. Any systematic excavation of these sites would, the form of grave goods, provide valuable evidence of the social status of the inhabitants.

Topographically, it appears that the earliest megalith builders particularly of the cairn circle or stone circle occupied the most elevated part or were close to the foothills. The distance between two adjacent cairn circles or stone circles was normally 2-5 m. Cairn circles with a cist burial generally rose 1-2 m above the ground level. The pattern of distribution that seemed to emerge from the survey was that for each locality within a 5 km radius there was a somewhat connected cluster of sites clearly indicating that these pastoralists controlled their economy within an area of the radius of 5 km. This pattern continued till c. 7-8th centuries A.D. as memorial stones also reflect the same phenomenon where the cattle raids took place within a distance of 5-7 km. In the case of dolmens/dolmenoid cists which are located on hill tops they generally are not in close proximity to each other.

Burial Types

Based on surface features, burials in the South Arcot district can be broadly divided into three groups: the cairn circle, the sarcophagus and the urn burial.

Cairn Circle

Cairn circles were constructed using round boulders with limited cairn packing at the centre, and their height above the ground depended to some extent upon the nature of the burial and the terrain. For instance, if the terrain was loose in texture then the cairns were lower in height while in the case of hard soils they were comparatively taller. Generally they had a diameter of 5-15 m, and included the following types:

1. Cairn circle entombing cist burial
2. Cairn circle with menhir
3. Cairn circle with an anthropomorphic figure
4. Cairn circle with slab circle

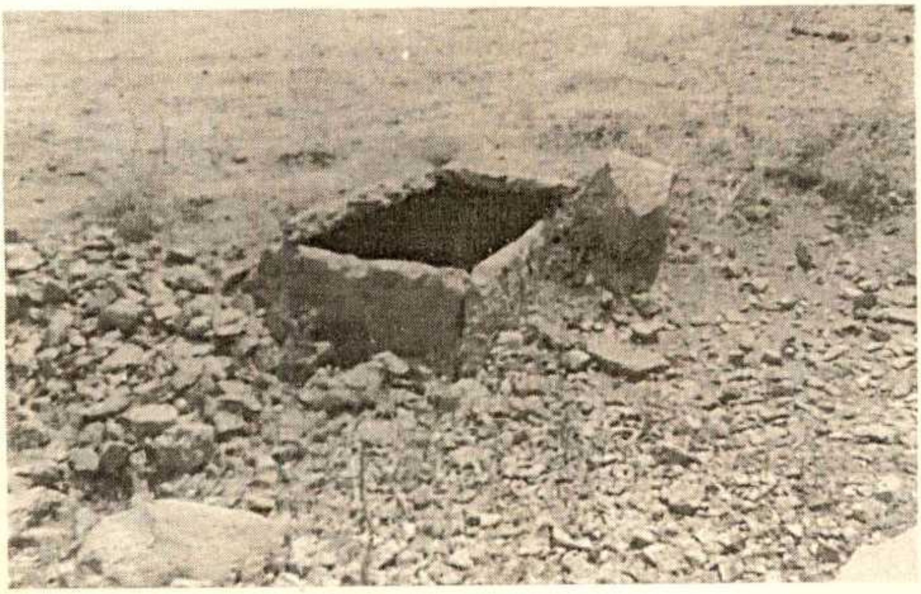

Fig. 4: Disturbed cist burial

5. Cairn circle entombing urn burial
6. Cairn circle entombing a sarcophagus

Cist Burial

The cist was a box-like structure of four orthostats positioned in a clockwise or anticlockwise direction and covered by a capstone. The eastern orthostat invariably had a round porthole at the centre. Due to the hidden nature of the cist it is as yet premature to comment on its further classification. However, data collected from some excavated burials, e.g. at Devanur and in some disturbed cists e.g. at Adichchanur, Porasapattu, etc., suggest that cists were not generally divided further to form what is called the transepted cist (Fig. 4).

Menhir

The only site of this type is at Devanur near Tirukkoyilur. A huge rectangular slab with a rounded edge at the top and measuring 4.50 m in height, 3 m in width and 15 cm in thickness was erected as a part of the circle (Fig. 5). This type of rectangular slab standing like a menhir has been seen at Mallachandram and Maharajakadai in Dharmapuri District (Rajan 1991a).

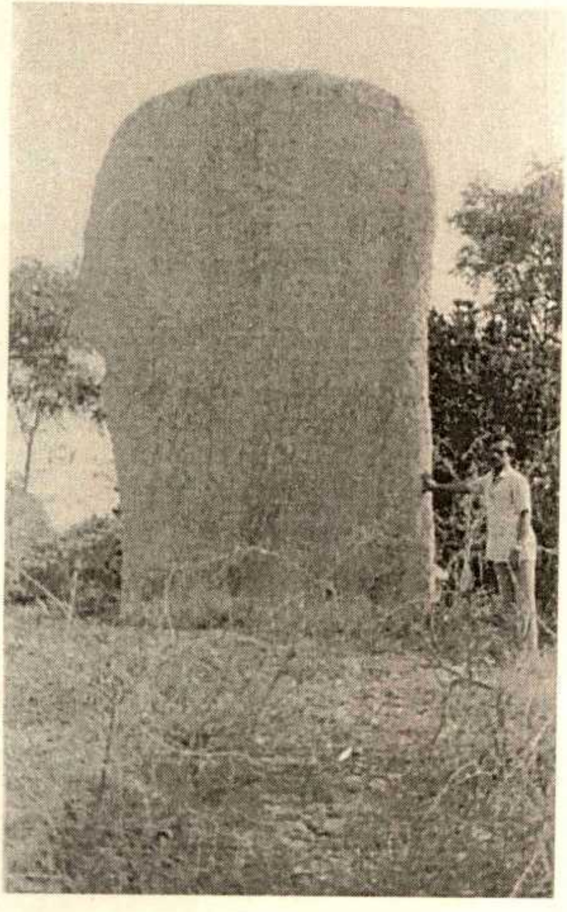

Fig. 5: Devanur: Menhir

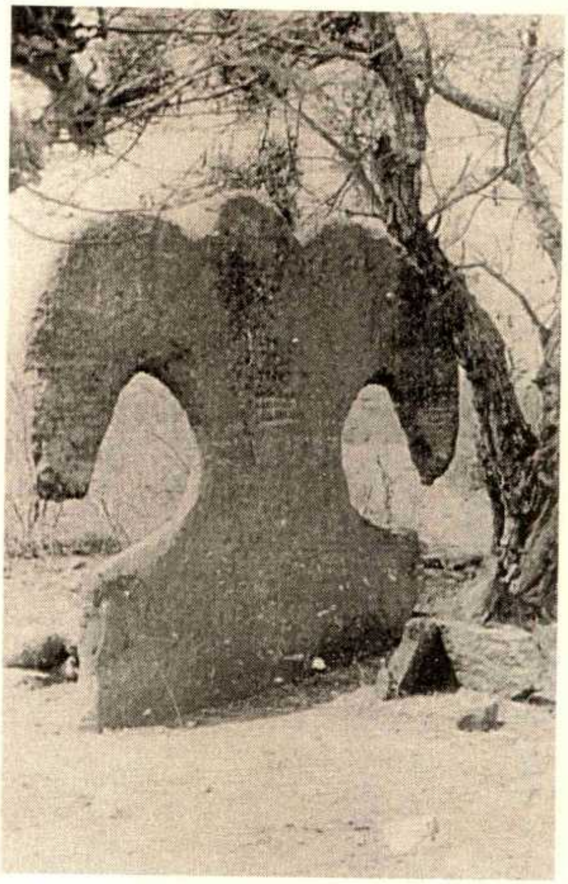

Fig. 6: Mottur: anthropomorphic figure

Anthropomorphic Stone Figures

B. Narasimhaiah (1980:201-202) made a unique discovery of a huge monolithic anthropomorphic figure at Mottur (Chengam taluka) 5 km north of Tanipadi and 25 km west of Tiruvannamalai. The anthropomorphic figure forms an integral part of three concentric circles. The outer two circles are built of stone slabs and in the middle circle facing south stands the anthropomorphic figure made of a well dressed slab measuring 3.25 m in width and 3.25 m in height and planted upright by scooping out the bedrock to a depth of 75 cm to secure it in position adding an adequate packing of murrum on either side. The figure has curved arms measuring 0.92 m, and the neck and head are represented by a semi-circular projection above the shoulder. A pedestal is provided instead of legs giving it the appearance of a seated figure (Fig. 6). An identical anthropomorphic figure was discovered earlier by the State Archaeology Department at Udayarnattam, Villupuram taluka (*The Hindu* dated 23-7-1982). Locally called *visiriparai* this figure formed part of the slab circle of a cairn circle entombing a cist burial with a round porthole on the east. This 3 m tall figure measured 1 m around its waist. The distance between the arm (110 cm broad) and the hip is

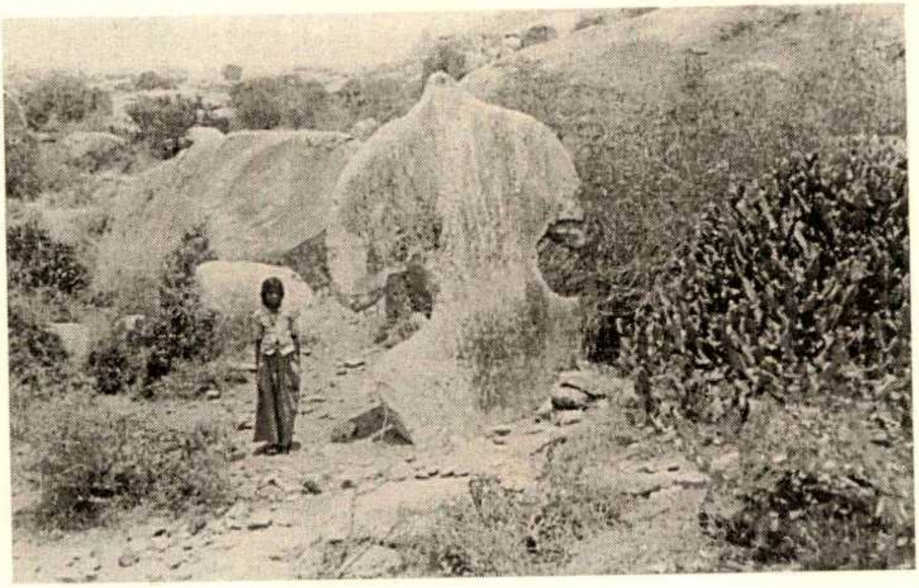

Fig. 7: Udayarnattam: anthropomorphic figure

50 cm. There is a triangular projection at the centre which looks like a neck (Fig. 7).

According to local tradition, when the *Valiyars* (pygmies) learnt that there would be a 'rain fire' they wanted to move southward to save themselves. They requested their God to come with them but He refused, so while leaving they cut off the head of the God and took it to the forest along with them. Hence this figure stands there without its head.

Similar figures have been reported elsewhere also. William King (1877) reported cruciform monoliths on the right bank of the Godavari at Kaperlaguru (13 km south-west of Mungapet, Paluncha taluka, Andhra Pradesh). Mulhern (1868) had also noticed some crosses on the bank of the Kaveri at Malur and Katapur. At Ambala Vayal in Kerala, certain projections resembling a head on a circular stone were observed by A. Sundara and K.J. John (Narasimhaiah 1980). Recently K.P. Rao (1988) reported two identical anthropomorphic figures from Midimalla near Chittoor. The first of these forms an integral part of the slab circle around the dolmen. The dolmen was surrounded by two slab circles with rounded tops placed at the cardinal points around the dolmen, as seen at Iralabanda (Branfill 1818) and Mallachandram (Rajan 1991a). The anthropomorphic figure stands on the east in the outer slab circle. The second one is also placed on the eastern side, but this dolmen is encircled with three slab circles. The circle slabs have a rounded edge and a rectangular flat top and were planted alternately around the dolmen. The slab with the rounded top occupies the cardinal point. The anthropomorphic figure placed in the mid-circle seems to have evolved from the earlier one. The curvature of the arms and shoulders are well turned down. The neck portion had some 'V'-shaped depression (Rao 1988: Pl. 14). But the first one noted above did not have any depression, instead it had a small round projection. Recently V. Rambrahman (1995-96) discovered dolmens with four anthropomorphic figures placed at the cardinal points as part of a slab circle. However, the figure on the southern side is presently missing at the Eguvakantala Cheruvu in Chittoor District, Andhra Pradesh. The anthropomorphic figure on the east had a round porthole. K.P. Poonacha (1995-96) has also reported a well developed form of three anthopomorphic figures at Kumati in Bellary District, Karnataka.

The presence of slab circles in the western part of Chittoor District led one to believe that the Mottur and Udayarnattam anthropomorphs might have also been derived from there (*The Hindu* dated 23.7.1982).

Anthropomorphic figures with heads but no arms were also reported from northern Andhra Pradesh, particularly on the south bank of the Godavari at sites like Tottigutta (Rao 1988:Pl. 15 and 16), Dongatogu (Khammam District, Andhra Pradesh) (Ahmad 1950).

Slab Circles

These were seen at Nayanur, Adichchanur and Udayarnattam. The upright slabs project 10-20 cm above the ground. The excavation at Mottur (North Arcot District) yielded three concentric circles in which the outer two circles are constructed of stone slabs (IAR 1978-79: 72-73). At Thondamanur the outer circle is also of stone slabs. The anthropomorphic figure at Mottur, Udayarnattam as well as the menhirs at Thondamanur form part of the slab circle (IAR 1978-79:21).

Cairn circles with slab circles were reported earlier at Sittannavasal in Pudukottai District (Krishnaswami 1949: 35-45), at Nattukkalpalayam in Coimbatore District (Harding 1889-94: 13-20), at Mukkudivelanpalayam, Panchalingapuram, Brough Nagar (Rajan 1987: 78-90) and Kodumanal in Periyar District (Rajan 1990: 93-102), and at Mungilpudur, Ittikal Agaram and Kuruvinayanpalli in Dharmapuri District (Rajan 1991a: 37-52). Sites like Mallachandram and Maharajakadai in Dharmapuri District also yielded slab circles around a dolmen. The site of Kuruvinayanapalli had a slab circle around the dolmenoid cist (Rajan 1991b).

The occurrence of slab circles observed in burials (cist, dolmen and dolmenoid cist) led one to believe that these slab circles were erected with a certain significance, because generally the slab circles were found in only one or two burials in a burial complex.

Sarcophagus

A sarcophagus primarily denotes a stone coffin usually adorned with sculpture or inscriptions. In Tamil Nadu these sarcophagi are found individually as well as associated with megalithic burials. They were used for secondary burial within tomb chambers like cists, dolmens and dolmenoid cists generally oriented east-west. Grave goods like Black and Red Ware pots, iron swords, spearheads, arrowheads, hoes, sickles, horse bits and stirrups were placed within and outside the sarcophagus.

A vast majority of the sarcophagi were of terracotta. The stone ones are monolithic troughs, and such types are reported from Dongatogu, Polichetticheugudda (Ahmad 1950), Pandurangapuram and Tottigutta (Rao 1988) all concentrated in Khammam District, Andhra Pradesh.

The sarcophagi were mainly concentrated in the eastern coastal plain particularly north of the river Pennaiyar in Tamil Nadu and south of the Godavari in Andhra Pradesh. A few were also reported from inland regions at sites like Maski (Thapar 1957), Sankavaram (Raghavan 1974), Jadigenahalli (IAR 1956-57:34-35), etc. Another set of sarcophagi were found against the Palaghat Pass in the districts of Trichur and Kozhikode in Kerala, at the sites of Chevayur (Logon 1887), Feroke (Aiyyappan 1933) and Kattankampal (IAR 1956-57: 93-115).

In Tamil Nadu, sarcophagi are found in abundance in Chingleput District and in the northern part of the South Arcot region. The occurrence of sarcophagus sites is drastically reduced when one moves south of the river Pennaiyar. On the other hand the occurrence of urn burials increases south of the Pennaiyar and decreases when one moves north of it. It seems that the sarcophagus and urn are similar modes of burial with only a slight variation in shape.

The available evidence suggests that the sarcophagus had its origin in the eastern coastal plain between the Godavari and Pennaiyar and moved slowly westward merging with the local tradition of the area. In Chingleput District and the northern part of South Arcot region, particularly in the coastal area, sarcophagi were found in pits or in stone circles. While moving westward they occur as interments in cists, dolmenoid cists and dolmens.

Sarcophagus burials can be divided into the following types:

1. Sarcophagi in pits
2. Sarcophagi in stone circles
3. Sarcophagi in cists

The sarcophagus directly placed inside a pit seems to be indigenous and was probably earlier than all other types. They were reported from Perambair in Chingleput District (Rea 1908-09). Quite interestingly one of the sarcophagi had no legs recalling another form of coffin or urn burial. In addition to this two upturned clay hooks at both the exterior ends of the sarcophagus were noticed. Such hooks are also found on the interior surface near the rim portion of the urn at some sites, e.g. Kalapatti and Nallurvayal (Coimbatore District) (Rajan 1987), in the south Arcot region as well as at Alagrammam, Kutteripattu and Vanur (Tindivanam taluka) and Kuchchipalayam (Panruti taluka).

The sarcophagi placed in stone circles were reported earlier at Perambair (Rea 1908-09), Kunnattur (IAR 1955-56: 23; 1956-58: 31; 1957-58: 37), Sanur (Krishnaswami and Soundara Rajan 1957: 189) and Pallavaram (Bidie 1887) all located in Chingleput District. During the author's explorations they were noticed at Ariyur, Nemili and Kappalambadi in Gingee taluka and at Sittamur (kil), Auroville, Kanthadu in Tindivanam taluka.

The two types described above were not noticed in the North Arcot region for the obvious reasons that their movement was westward where it mingled with the existing dolmenoid cists and dolmens as noticed at Karikal, Mamandur, Wandivasal (Narasimhaiah 1980) and during the present explorations at Karkur, Pogalur and Kilseppuli.

The sarcophagus placed inside the cist and oriented east-west was reported from the excavation at Mottur by L.K. Srinivasan (IAR 1978-79: 72-73), from Odugattur (Richards 1954) and Sembadavankottai in North Arcot District. In this region, the sarcophagus placed inside the cist as an interment is noticed at Andali, Devanur (Garstin 1876), Melkalpundi, Nayanur, Mullur and Paranur in Tirukkoyilur taluka and Karuvakshi in Villupuram taluka. Its association with the dolmen is seen at Kilseppuli, Ariyur and Karikanthangal in the North Arcot region

(Rajan 1991a), and at Mallachandram in Dharmapuri District (Rajan 1993: 251-270). The lone example where it is associated with a dolmenoid cist occurs at Settavarai in Gingee taluka.

The above mentioned sepulchral representations clearly indicate the adaptation of the sarcophagus by various groups depending upon their local tradition thereby demonstrating the close relationship between different social groups.

Types of Sarcophagi

A sarcophagus is generally a coffin with an oblong or bathtub-like shape with cylindrical legs fluted at the base either in one or more rows, e.g. the one at Paiyampalli had 24 legs (IAR 1964-65: 22-23; 1967-68: 26-30).

Sites yielding sarcophagi from the coastal area had dome-shaped lids whereas those unearthed at Mottur (IAR 1978-79: 72) and Paiyampalli (Rao 1964-65: 22-23) did not. It can also be hypothesised that the sarcophagi placed in a pit burial (with only a capstone) had lids whereas cists, dolmenoid cists and dolmens with sarcophagi are without lids. This clearly indicates that the capstone of the tomb itself served as a lid thereby suggesting that the lid did not have any ritual significance but was only functional. A sarcophagus without legs was also reported from Perambair (Rea 1908-09), but this appears rather like another form of urn burial.

Dolmens and Dolmenoid Cists

The only site yielding both these types is Settavarai in Gingee taluka. The dolmenoid cist with a 'U'-shaped porthole was noticed on a hill top. The location of the site suggests that the people practicing this type of burial probably did not have much contact with the people of the plains.

Urn Burials

The predominant burial practice in this region is of urn burials — found in pits on the coastal area, and in cists in the upper region. This form occurs mainly in the delta area south of the river Pennaiyar. Its upward movement could be clearly observed along the Vellar River, and it even penetrates Harur taluka (Dharmapuri District) after crossing the Attur and Manjavadi passes (*kanavai*).

The urns resemble tall jars with thick walls. The base is slightly pointed ending in a small knob, while the belly of the urn sometimes was 3-4 m in diameter. The sagger base urns are mostly ovoid in shape.

Grave Goods

Among the objects unearthed were iron sickles, knives, spearheads, arrowheads, axes, nails, etc., ornaments like bangles and beads made of shells, glass and terracotta, as well as gold ornaments and terracotta birds and animals.

The ceramics of the Megalithic culture consist of Black and Red Ware, Black Ware and Red Ware. Besides these a coarse Red Ware painted in chocolate or light brown exclusively on the outside, and also in orange pigment were noticed. The former is found in the habitation areas and the latter in the burials.

The economy of the megalithic peoples appears mainly to be based on agriculture and cattle rearing, supplemented by hunting. Besides this iron working must have been practiced as seen by the profusion of iron slag. Cereals and pulses, horse gram and green gram were cultivated. The animals domesticated or hunted included cattle, sheep, pigs, the jungle cat and rhinoceros.

Grave goods are found on the floor slab or the base of the cists, dolmens and dolmenoid cists. They were also found inside and outside sarcophagi or urns. The main pot forms are conical vases, bowls, dishes, tulip-shaped vases, and pots of Black and Red Ware. Ring stands and lids are all of Black Ware. A three-legged vase in Red Ware was also noticed. Iron implements from the burials include arrowheads, spearheads, chisels, knives and daggers, while beads of etched carnelian and shell were also found.

Conclusion

Three distinct Megalithic traits emerge from this study — the cairn circle, urn and sarcophagus burials. Confined to three separate geographical zones, these three traits overlapped in the contact areas of the three zones. This indicates that there was an assimilation and acceptance of other cultural traits. People practicing urn burial and mainly occupying delta regions had an agriculture-based economy, whereas those using the cairn circle were partly agricultural and partly pastoral.

Acknowledgement

I am grateful to Sri T. Subramaniam, Curator, State Archaeology Department of Tamil Nadu for accompanying me throughout my field work and also for our fruitful discussions.

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Explorations at Gopalpur, District Nayagarh, Coastal Orissa

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Introduction

Several Neolithic sites were discovered around Pallahara and Kantala (Angul District) during a recent survey conducted by the Department of Anthropology, Utkal University, Bhubaneshwar. The prehistoric site of Gopalpur was one of them (Kar 1992; Tripathi and Kar 1993). It was surveyed during 1995-1996 (Kar 1995-96).

Three sites (Fig. 1) have yielded important Chalcolithic evidence in Orissa (for a general review see Basa 1994, 1997): Sankerjang, Angul District (Dash 1986; Yule *et al.* 1990), Kuanr, Keonjhar District (Ray 1993) and Golbai Sasan, Khurda District (Sinha 1993; Sinha in press). The Neolithic culture in Orissa is however, more widely distributed. While Dash (1987) studied the Neolithic of Orissa from the viewpoint of distribution, typology and raw materials used, Behera (1992a) argued that the Bonaigarh Neolithic complex had a pebble tool component and that Sulabhdihi in Bonaigarh was a rich Neolithic celt manufacturing centre using dolerite as the raw material (Behera 1992b). Prior to this evidence, Baidyapur in Mayurbhanj District had yielded Neolithic material in association with pottery and rice grains (Banerjee 1930: 39-40). A small-scale excavation at Kuchai by B.K. Thapar in 1960s yielded the Neolithic artefacts made by the grinding and polishing technique, a coarse grit-tempered Red Ware (in some cases applied and showing incised and finger-tip decoration) and orange-brown ware (Thapar 1985: 45).

Site of Gopalpur

Gopalpur village (20° 01' 52" N; 85° 21' 19" E) is situated 72 km south of Bhubaneshwar, in Nayagarh District (Fig. 1). The small mound located near the village on its northern side is locally known as Jagati. It is oriented in N-S direction and it is approximately 140 m long, 115 m wide and 9 m high. A small stream locally called the Khatiari flows from west to east cutting through the mound and exposing a section that contains a variety of artefacts such as celts, potsherds, burnt clay fragments, fragments of rubbing stones and bones.

Lithic Remains

The celts are of two types: those made on dolerite and those on basalt (Fig. 2), and they also occur in two sizes. The larger celts are triangular in shape (maximum length, breadth and thickness are 11.5, 6.5 and 1.5 cm respectively). The smaller celts are trapezoid and flat (maximum length, breadth and thickness are 5.5, 4.5 and 1.5 cm respectively). Several fragments of celts as well as pieces of dolerite chunks were also found at Gopalpur. Exploration of the environs of the site yielded a few fragments of rubbing stones, pestles, querns and perforated stones (Fig. 3). These might have been used for sharpening weapons and grinding food grains, while the perforated stones may have been used as a free wheel under the bamboo screen of fish traps.

Pottery

A large number of potsherds, mainly wheel-turned, have been noticed at the site (Fig. 4-6) and include Red Ware, Red Slipped Ware, a dull red ware, Gray Ware, Cream Slipped Ware, Chocolate Ware, Black-and-Red Ware and Burnished Black Ware (a possible prototype of NBP ware). A few sherds are handmade and perhaps some were made on a turn table. The main shapes include the vase, the *handi*, dish, shallow dish, bowl, ring-based bowl, tumbler, lid and miniature pot.

Animal Remains

The animal remains at the site are represented by a small — thirty seven bones — collection made from the surface. Thirty one were identifiable and revealed that even such a

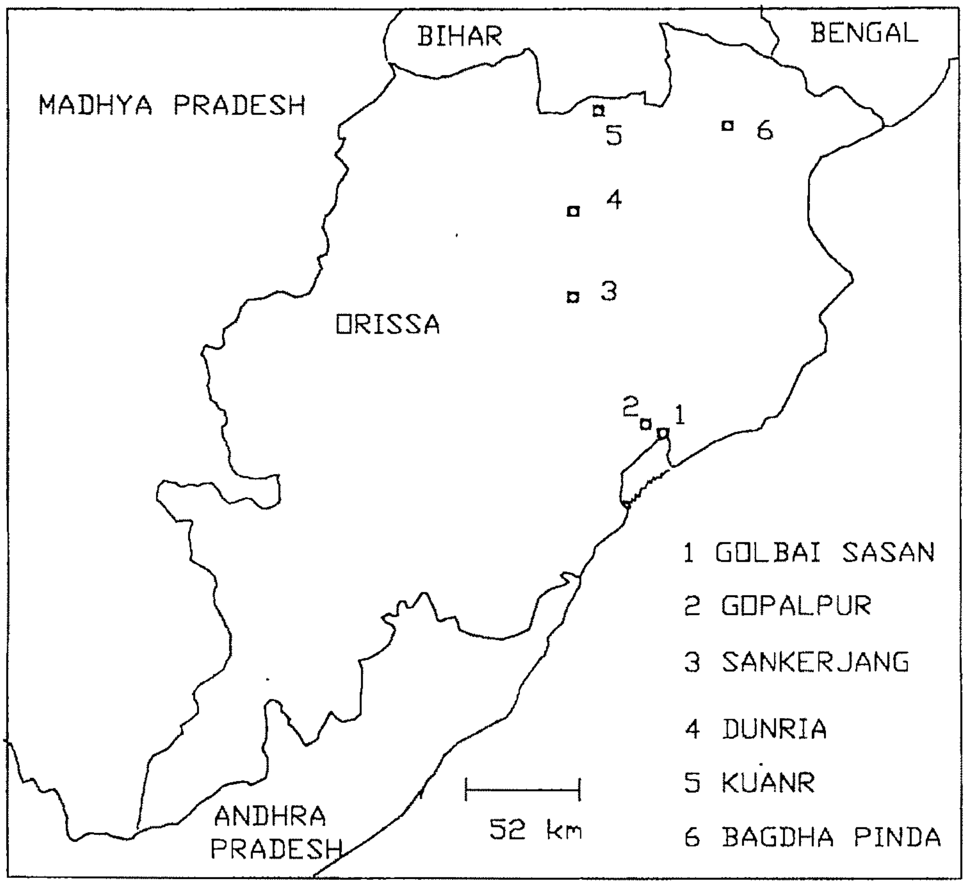

Fig. 1: Distribution of Neolithic-Chalcolithic sites in Orissa

small collection represents 2 domestic (cattle and buffalo) and 4 wild species (nilgai, chital, wild pig and rhinoceros). The total weight of the bones was 2.593 kg and most of the fragments were large, including the unidentified pieces (Table 1).

Although this is a surface collection of bones, it represents a variety of the skeletal elements of cattle (Fig. 7) and buffalo (Fig. 8). The former include a femur, a partially charred tibia, two distal fragments of the humerus (one with a cut mark) and a fairly complete portion of the left mandible. Buffalo bones (6) include a fragment of cranial (frontal) bone, a proximal portion of a radius, a complete patella (knee cap), a broken mandible, a complete first phalanx and partially charred proximal portion of a metacarpal bone.

Fourteen bones were identified as *Bos/Bubalus* since it was not possible to decide the exact species status. These bones include two complete molars of the upper jaw, one rib fragment, two cranial bones, a fragment of pelvic bone, a cut portion of the vertical ramus of a mandible, two nearly complete vertebrae with fused central plates, one distal fragment of a humerus, a metapodial without the distal unfused epiphysis, one tooth (possibly a lower premolar) and two distal fragments of either a tibia or a humerus fashioned as tools. One of these tools is like a borer/point whose tip has been fire hardened and the other has been fashioned into a side scrapper.

Wild animals are represented by only six bones (Table 1). The wild pig is represented by the proximal portion of the ulna bearing a cut mark perpendicular to the long axis. Other wild animals are nilgai (two metatarsals); chital (one fragment of the antler (Fig. 9, right), and one mandible fragment); and rhinoceros represented by a nearly complete second phalanx (Fig. 9, left).

It is possible to estimate the fat-free carcass weight and height of the cattle based on the measurement of the distal portion of the humerus (Noddle 1973). It was possible to measure a few bones (Table 2). Studies on the two humeri (GPL1 and GPL 4) from Gopalpur give us estimates of the fat-free carcass weight of the cattle to be 147 and 151 kg respectively. This indicates that cattle at Gopalpur were at least of a medium-built variety. Also the

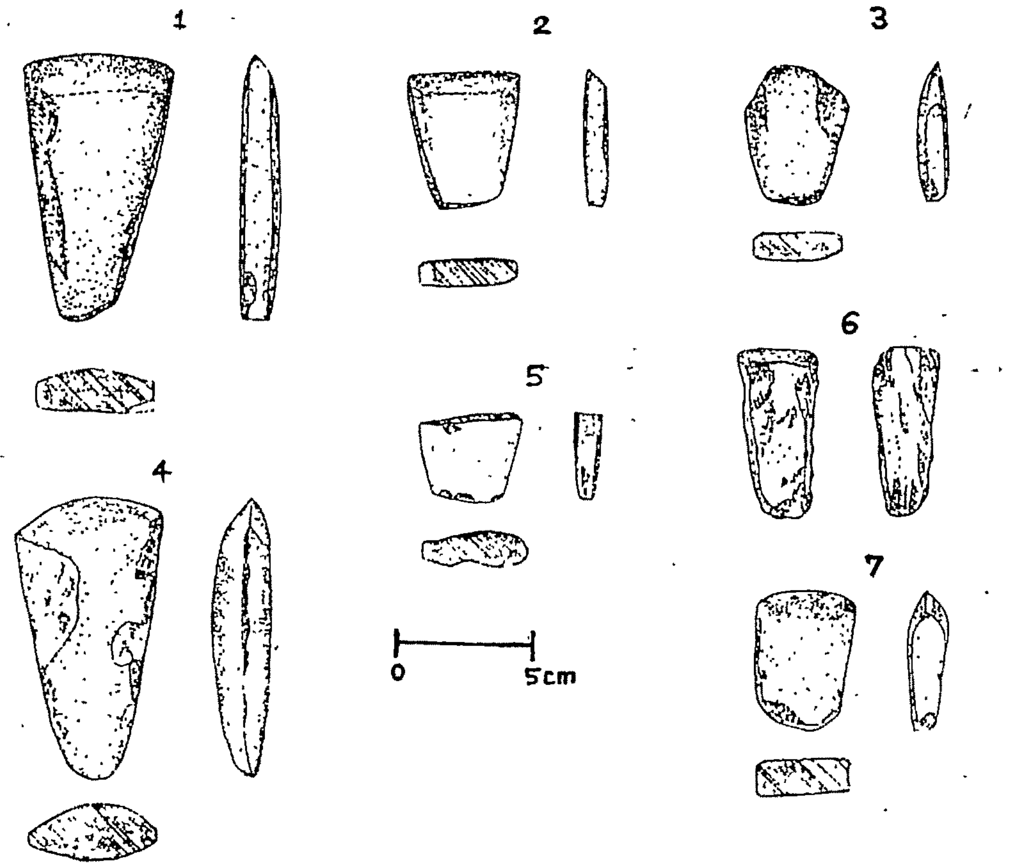

Fig. 2: Celts from Jagati (Gopalur): 1 and 4 large type, 2, 3 and 7 small type; 5 celt fragment; 6 celt of chipped type

Table 1: Gopalpur: animal species identified

Species		NISP	Weight (g)	Weight/Fragment (g)
Bos indicus	(cattle)	5	970	194.00
Bos/Bubalus		14	561	40.07
Bubalus bubalis	(buffalo)	6	605	100.83
Boselaphus tragocamelus	(nilgai)	2	200	100.00
Axis axis	(chital)	2	65	32.50
Sus scrofa	(wild pig)	1	12	12.00
Rhinoceros unicornis	(rhinoceros)	1	40	40.00
Number of identified specimens		31	2543	82.03
Unidentified (UF)		6	50	8.33
Total		37	2593	70.08

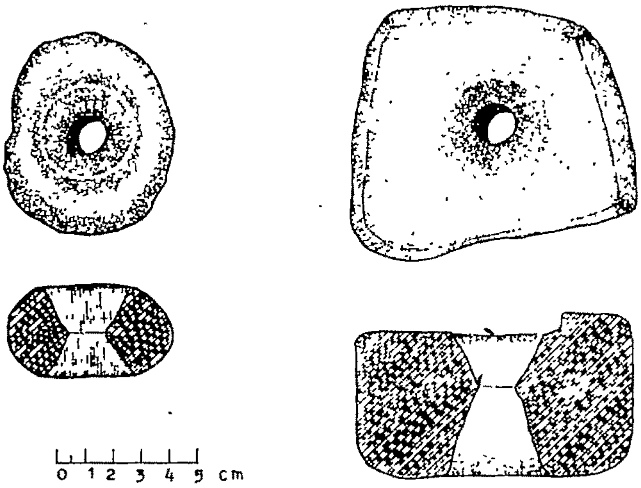

Fig. 3: Gopalpur: perforated stones

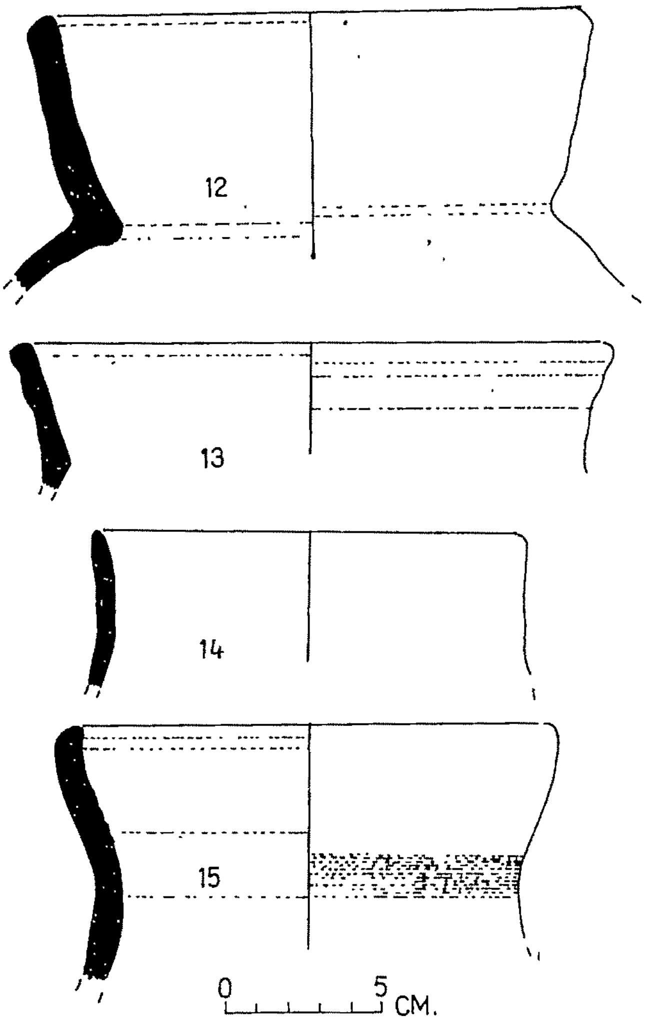

Fig. 4: Gopalpur: pottery; 12 high-necked jar (Cream-slipped Ware); 13 high-necked jar (Black and Red Ware); 14 bowl (burnished Black Ware); 15 high-necked jar (Red-slipped Ware)

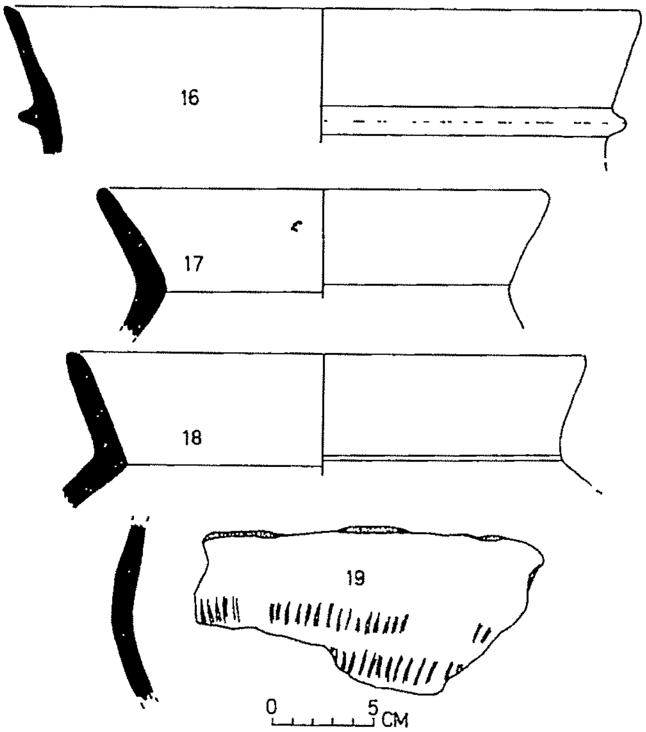

Fig. 5: Gopalpur: pottery; 16 and 18 High necked jar (Red Ware); 17 High necked jar (Cream Slipped Ware); 19 Cord impressions on Red Ware sherds

general size of the bones suggests that cattle of a medium-heavy build also could have existed at Gopalpur.

Other Remains

Although the villagers here have collected copper and iron implements, no metal implements were recovered by us from the surface during our explorations at and around Gopalpur. However, evidence for iron smelting has been found during the explorations at Dangala and Gothapada, on the southeast and south of the modern village of Gopalpur. A few pieces of iron slag and terracotta pipes (Fig. 10) were found scattered in these three areas.

On the eastern side of the modern village, two ancient sculptures both made on Khondalite were found on the surface: one is a Mahishamardini (150 cm long and 75 cm wide) and the other a headless Dhyani Buddha. At the nearby village (1 km eastwards) of Ramchandrapur Sasan, remains of some ancient temples were also noted during our exploration.

Comments

Golbai Sasan (20 km from Gopalpur by road towards the southeast) is one of the most important excavated sites in this region. Here three cultural phases have been identified

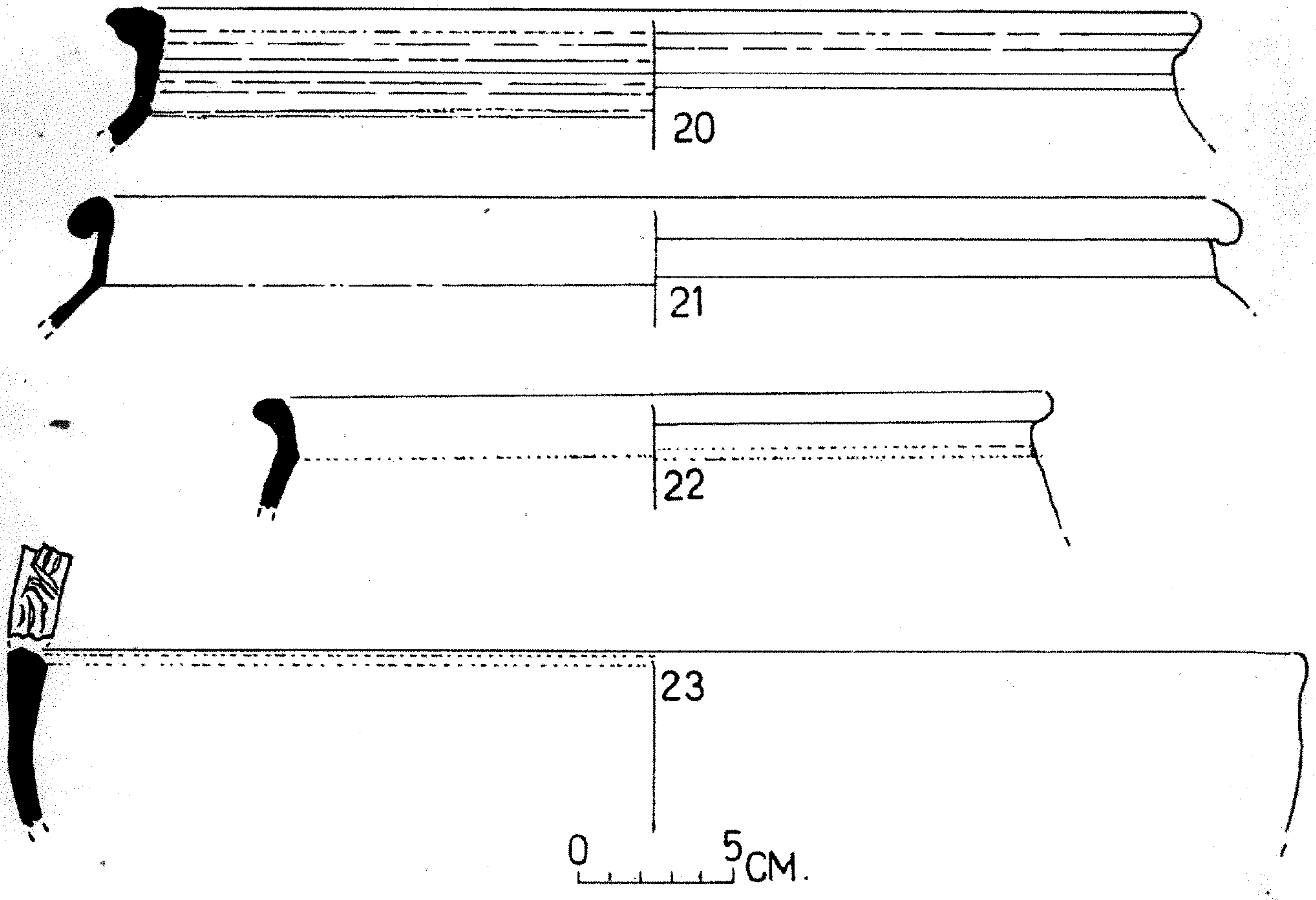

Fig. 6: Gopalpur: pottery; 20 Vase (Grey Ware); 21 Vase (Chocolate Ware); 22 *Handi* (Grey Ware); 23 Basin (Grey Ware)

— Period I: Neolithic, Period IIa: Osteo-Chalcolithic, and Period IIb: Ferro-Chalcolithic (Sinha 1993, Sinha in press). It may be useful to compare this evidence with that from Gopalpur although the latter is only a surface collection. Like Golbai Sasan Period I, Gopalpur has yielded Neolithic celts and querns. The pottery of the two sites from Period I (i.e. red and grey ware) is also comparable. Black-and-Red Ware found at Gopalpur Period IIA is similar to that found at Golbai Sasan Period IIa in respect of shapes. Based on the remains of pottery, it can be said that Gopalpur was also a Neolithic-Chalcolithic site like that of Golbai Sasan. A preliminary description of animal bones at Golbai Sasan (Sinha in press) indicates that humped cattle, sheep and goat were present. In addition to the bones of domestic animals at Gopalpur, bones of several types of wild animals have been found. However, unlike Golbai Sasan, Gopalpur has not provided evidence of a rich bone tool industry.

Acknowledgements

We wish to thank Prof. K.C. Tripathi for his encouragement during various stages of the exploration and Mr. Shrikant Pradhan for preparing the drawings.

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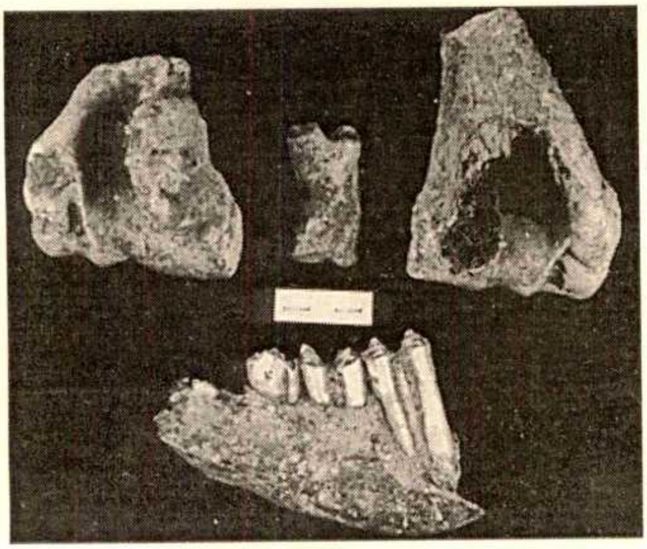

Fig. 7: Gopalpur: cattle bones

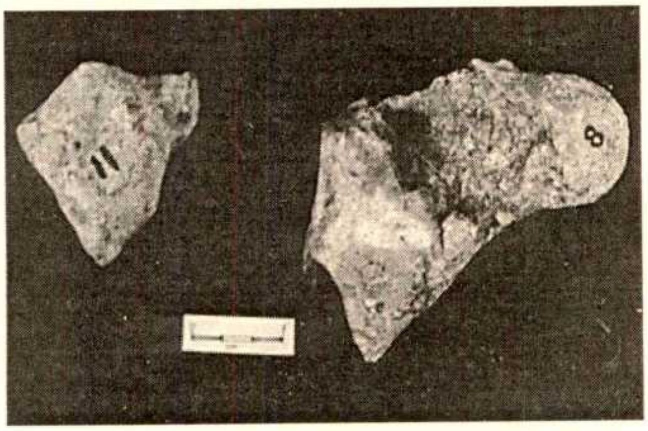

Fig. 8: Gopalpur: buffalo bones

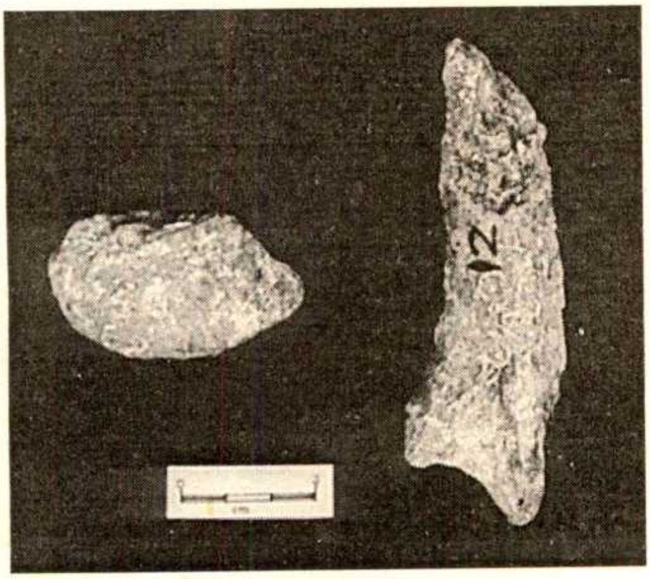

Fig. 9: Gopalpur: wild animal bones; left: rhinoceros phalanx, right: antler of chital

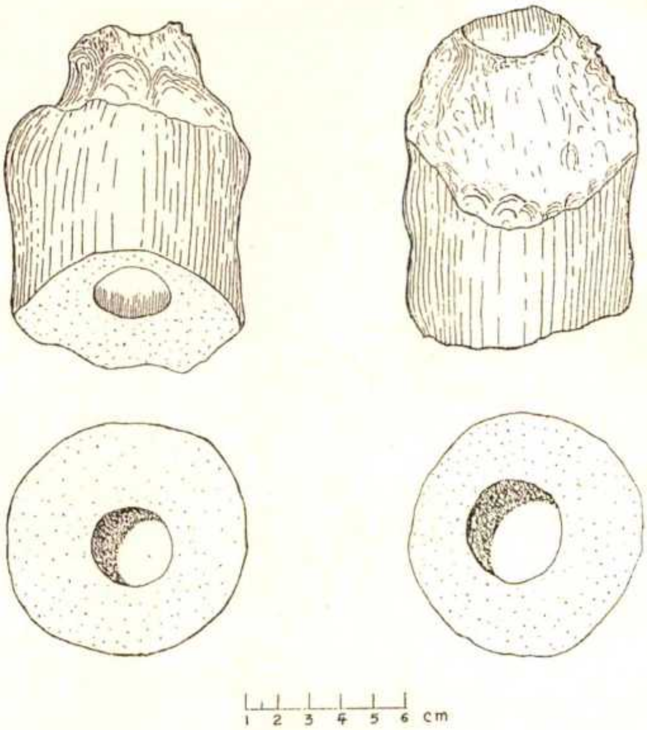

Fig. 10: Fragments of terracotta pipes

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Table 2: Gopalpur: measurements (mm) of animal bones

No.	GPL 1	GPL4
Bone	Humerus	Humerus
Species	*Bos indicus*	*Bos indicus*
Maximum distal width	78.06	76.00
Width of the trochlea	69.00	71.44

No.	GPL 7
Bone	Tibia
Species	*Bos indicus*
Maximum distal width	56.21
Maximum distal thickness	42.00

No.	GPL 8
Bone	Femur
Species	*Bos indicus*
Length of the capitulum	56.77
Width of the capitulum	42.82

No.	GPL 6
Bone	Upper Molar
Species	*Bos/Bubalus*
Length	30.27
Width	13.36

No.	GPL 3		
Bone	Mandible with pm4, m1 and m2		
Species	*Bos indicus*		
Length	pm4 19.00	m1 24.12	m2 26.12
Width	9.95	12.55	12.00

No.	GPL 9
Bone	First Phalanx
Species	*Bubalus bubalis*
Maximum length	51.45
Proximal width	28.52
Proximal thickness	28.82
Distal width	28.15

No.	GPL 11
Bone	Patella
Species	*Bubalus bubalis*
Length	65.68
Width	59.00
Thickness	34.30

No.	GPL 10
Bone	Mandible with only third molar
Species	*Bubalus bubalis*
Length of m3	30.27
Width of m3	13.36

No.	GPL 5
Bone	Radius
Species	*Bubalus bubalis*
Maximum proximal width	71.00
No.	GPL 2
Bone	Metatarsal
Species	*B. tragocamelus*
Maximum distal width	40.57
Distal thickness	27.40
Thickness of the trochlea: lateral part	18.68
Thickness of the trochlea: medial part	28.00

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Book Review

Zarine Cooper. 1997. *Prehistory of the Chitrakot Falls, Central India.* Pune: Ravish Publishers. pages 115. Price: Rs. 685.

This monograph is based on the archaeological and enthographic research which Zarine Cooper conducted in the Bastar area of Madhya Pradesh between 1978 and 1981 and submitted as a Ph.D. thesis to the Univesity of Poona in 1983. It is rather unfortunate that one had to wait for 15 long years to see the thesis in print, but it is better late than never! This monograph is a substantial addition to the literature on Stone Age research in the country. Indeed this is one contribution which would have made a person like Sir Mortimer Wheeler realise that the study of India's Stone Age past is much more than a matter of 'stones' and 'more stones.' Cooper's work proves that it is possible to clothe these stones in flesh and blood and reconstruct hunter-gatherer adaptations of the distant past — in the present case using the tiny implements of the Mesolithic phase.

The monograph is divided into 8 neat chapters as follows:

Chapter 1 is introductory in nature and gives a brief review of the Mesolithic excavations conducted in various parts of the country during the last quarter-century, highlighting the shift of focus that took place from the typological and geological approaches to stone tool assemblages to an anthropological perspective which lays special emphasis on the concept of human adaptation. Cooper then provides a short account of the sporadic discoveries of Stone Age sites of various phases made in the study area over the last 40 years. Her own work under review on the Mesolithic phase took its cue from V.D. Krishnaswami's discovery of a microlithic site at Chitrakot some 45 years ago.

Chapter 2 is a brief account of the geographical features of the study area (geological formations, topography, climate, drainage and biological environment) measuring 230 km^2 in extent. One half of it is formed by the stretch around Chitrakot waterfall on the river Indravati, which is a tributary of the major river Godavari. The waterfall — a horseshoe-shaped formation — is about 30 m in height and about 180 m wide. When the river is in spate, the spot obviously presents a great spectacle. The other half of the area is formed by a plateau strip of basalt on which is located the village of Michanar. Cooper's intensive field survey covering a total period of 12 months has clearly shown that the Mesolithic sites are concentrated in the waterfall area along the river, including some sites which are located on the tributary streams. Barring some isolated flakes, practically nothing has been found on the Michanar plateau strip.

Chapter 3 describes the methodological framework adopted in the study. The main point to be emphasized is that this study is based on intensive field surveys, coupled with some sondages of a microzone. Cooper's foot surveys brought to light 49 microlithic sites in the waterfall area. These are basically surface sites but at some spots a shallow soil deposit (40 cm) is preserved. In terms of horizontal extent these sites range from 25 m^2 to 20,000 m^2 and are separated from each other by distances ranging from 10 m to 1 km. An important aspect of these sites which needs to be highlighted is that all of them are located within a distance of 1 km from the perenial water source as formed by the Indravati. In some cases there is a tendency for sites to occur in a cluster.

Cooper has not only adopted intensive survey to locate sites but selected nine of them for detailed mapping and plotting of the artefactual record scattered on them. An important observation arising from her study pertains to post-depositional processes like erosion, devegetation, human trampling and gravity drift which may have to a smaller or larger extent modified the original positions of artefacts or what the reviewer would term as point provenance. One should be very alert while using such data for making fine-grained inferences about intra-site patterning. At the same time it is equally important to remember that the Chitrakot complex sites are primary in character in respect of what the reviewer calls spot provenance and as such are of inestimable significance for reconstructing prehistoric technology and settlement systems. This inference holds as it were the key to the future of Stone Age archaeology in peninsular India, and has already been put to use with many benefits in areas like the Raisen district (M.P.) and Hunsgi and Baichbal valleys (Karnataka).

Chapter 4 is devoted to a detailed study of the typo-technological features and raw material composition of the various lithic assemblages. The Chitrakot Mesolithic industry is a short blade industry based on the working of chert and quartzite as the principal raw materials. With the help of diagrams, graphs and tool drawings Cooper has given a very lucid account of the major aspects of the lithic industry including its metrical features. In the last section of the chapter the author seeks to reconstruct the functional aspect of the lithic industry. For want of biological materials and use-wear studies such inferences must remain at the speculative level. But this is not to deny that the lithic implements would have been put to use in a wide variety of situations related to hunting-gathering, fishing and other daily activities of the Mesolithic community.

In Chapter 5 Cooper, making use of computer-aided statistical techniques, examines artefact distribution at nine of the important sites in order to understand possible intra-site patterning. Her study has shown that post-depositional processes like vegetation removal, soil erosion and slope activity could have produced artificial clusters within the sites. She also recognises that one has to be extremely careful about the identification of activity areas.

Chapter 6 is just a matter of six pages but constitutes a fine interpretative statement of the archaeologial record of the study area. These inferences serve as an eye-opener to all serious students of Indian prehistory.

1. The lithic material which one finds in large quantities on Stone Age sites in India (for example, site CRT-19 at Chitrakot has 28,594 pieces!) is only one component of the total record, of which organic materials like food residues and wooden and bone artefacts have vanished in the course of time.
2. One should be cautious about the distinction which Indian prehistorians often make between camp sites and workshops.
3. Surface sites of the Stone Age past are too ubiquitous in India to be ignored any longer. In fact any advances in Indian prehistory are intimately linked with the formulation of relevant strategies for studying these sites.

Considering the Chitrakot materials in terms of the settlement system perspective, Cooper rightly infers that the Mesolithic community of this area was a semi-sedentary community. The waterfall area witnessed intense and probably polycylic human activity of various types during the dry season such as camping, tool-manufacture, resource acquisition and food processing. Cooper feels that this aggregation in the dry season was greatly facilitated by a constellation of factors, especially the availability of rich acquatic resources (the Indravati has over 30 fish species) and plant foods. In the wet season river flooding imposed space limitations in the waterfall area, and the human community, while it did not desert the riverine zone altogether, spread laterally and occupied the stretches along tributary streams where one finds small sites. So, in a general way, the Chitrakot Mesolithic settlement system belongs to the aggregation-dispersal pattern.

Chapter 7 is a detailed ethnographic account of the Kurŭk tribal community (a Dravidian-speaking group) living in the area. The Kuruk, although not native to the area, have a seasonal adaptation pattern very similar to that of the Mesolithic community. The Kuruk use of the landscape and various aspects of their way of life — dwelling structures, division of labour, various items of hunting and fishing equipment and, most important, the rich fish resources that they exploit from the Indravati River, constitute an excellent living example of what might have happened in the Mesolithic past.

The monograph is illustrated with 27 photographic plates and over 70 line drawings and figures. The references and index provided at the end of the monograph are very helpful. From both methodological and interpretative points of view, Cooper's book marks an important advance in Indian prehistory and provides stimulating reading to workers both in India and outside. The printing of this book is superb and for this M/s. Ravish Publishers deserve our warm congratulations.

Finally, it is good to remind oneself that one of the extra benefits of doing archaeological research in the countryside lies in the opportunity that one gets to interact with a much larger section of human society. Cooper, in her Preface, makes a pointed reference to the village folk of Chitrakot area and says that they "proved to be the best instructors, and kindest friends; the city dweller has much to learn from them." Having spent the first 15 years of my life in a village and the next 40 years in urban setting I find it difficult to disagree.

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Obituary

Zainuddin Dawood Ansari
(1923-1998)

Dr. Z.D. Ansari (just Shaikh to the late Prof. H.D. Sankalia), one of India's foremost field archaologists and closely associated with the rise of the Deccan College Department of Archaeology as a major centre in the discipline, died at the age of 75. For the last year he had been suffering from brain-related ailments and had to undergo a surgical operation, after which he became very weak and even lost his speech and other mental faculties. The end came on 18 February 1998. It is a rare coincidence that his wife, Mrs. Sugra Ansari, who had been hospitalised a fortnight earlier for surgery to cure a gangrene-related problem, also died the day after Dr. Ansari.

Born at Narayangaon (Pune District) to a family of weavers, Dr. Ansari's career in archaeology is a shining example of the rise from rags to riches in the academic world. By sheer dint of sincerity, honesty, hard work, and with the steady support of Prof. Sankalia, he rose from being a mere technician to the position of a senior faculty member. Dr. Ansari's selection and entry into the Deccan College is another example of Prof. Sankalia's matchless ability to spot the right person for the right job. Already by 1948, less than a decade after he joined the Deccan College, Prof. Sankalia had developed a strong component of field archaeology covering both the Stone Age and historical sites of Maharashtra and Gujarat. In this although he was initially helped by his pupils like A.V. Naik and D.R. Patil, Prof. Sankalia soon felt the need for a technical hand to look after the practical aspects of explorations and excavations, photography and drawing work. It was at this juncture that he spotted Ansari, who had just completed his training in photography under Shri J.P. Joglekar of the Archaeological Survey of India.

Ansari joined the Department as a photographer-cum-surveyor in 1948 on a monthly salary of Rs. 100/-. He adopted the policy of 'learn while you earn' and completed his B.A. degree in 1952 and M.A. degree in Ancient Indian Culture and Archaeology in 1954. In 1957 he was promoted and appointed Curator of the Department Museum and then a Lecturer in 1963 by which time he had completed his doctorate on "Geometric Approach to Ancient Pottery". Finally, he was promoted as Reader in Field Archaeology in 1967, from which post he retired in 1983.

The late Prof. S.B. Deo and Dr. Ansari claim a major share in many excavations and field programmes which Prof. Sankalia undertook in different parts of the country from the 1940s to the 1980s. The excavations with which Dr. Ansari was associated include Nevasa, Navdatoli and Ahar (with H.D. Sankalia and S.B. Deo), Tekkalakota and Sanganakallu (with H.D. Sankalia and M.S. Nagaraja Rao), Chandoli (with S.B. Deo), Apegaon (with S.B. Deo and M.K. Dhvalikar), Kayatha (with M.K. Dhavalikar), Dwaraka (with M.S. Mate) and, of course, the site of Inamgaon (with H.D. Sankalia and M.K. Dhavalikar) which was excavated from 1968 to 1982.

Dr. Ansari possessed tremendous physical stamina and would remain in the field for months together. He was a field archaeologist *par excellence* and possessed a complete knowledge of the smaller and larger aspects - both technical and academic — of undertaking field projects of various types. It is little surprise that Prof. Sankalia heaps praise on Dr. Ansari in his autobiography, *Born for Archaeology*: "Another trusted lieutenant I found in Shaikh — Dr. Z.D. Ansari. Ever ready to do any kind of work, Shaikh has shown exemplary tenacity of purpose as well as character in achieving what he has set out to accomplish for himself as well as for the Department. Hence it is no exaggeration to say that whatever success I have acheived in establishing an Archaeology Department is due to selfless and devoted services of these two pupil-assistants (Drs. Deo and Ansari). When Dr. Deo was away in Nepal and then at Nagpur, Shaikh was one pillar on whom I could always stand" (p. 59). True to his well-known trait of using the past to compose similies and metaphors, Prof. Sankalia often used to liken Dr. Ansari to a handaxe - a multipurpose tool.

As Field Director of the excavations undertaken by the Institute from the 1950s to the 1970s, Dr. Ansari was responsible for initiating into field archaeology about 30 successive batches of M.A. and Ph.D. students who studied in the Department. For the stimulating training they received they will ever remain grateful to him and the present writer proudly recalls his own initiation into excavation at the hands of Dr. Ansari in 1964 at the Neolithic site of Tekkalakota (Karnataka).

It is often said that science is nothing but organised commonsense. Field archaeology simply ceases to exist without commonsense, which Dr. Ansari possessed in great abundance. He judiciously tempered the principles of excavation extracted from the manuals with his robust commonsense. One has still before one's eyes a vivid picture of Dr. Ansari at the excavation site — dressed in a soldier-like fashion and ready for any task, with a broad-brimmed hat on his head, a knife and a brush in his hand, a notebook, a pencil and a magnifying glass in shirt and trouser pockets making the rounds of various trenches and always giving polite instructions and practical suggestions to the trench supervisors and workmen about the day's job. He used to emphasize that using a knife and a brush correctly was the best introduction to field archaeology. Totally disregarding the heat and dust which are unfailing companions at any Indian archaeological site, students loved to learn under his guidance the various components of field archaeology: like surveying and map-making; exposing house floors, structures and human skeletons; section drawing and interpretation; three-dimensional recording; photography; etc. They will also fondly recall the river valley explorations which Dr. Ansari used to conduct on holidays when he would introduce students to aspects like reconstrution of terrace sequences, and looking for stone tools and animal fossils in gravel and silt deposits. Dr. Ansari had an uncanny eye for discovering animal fossils and built up large collections in the Department — this at a time when geologists and archaeologists showed little interest in them.

Dr. Ansari was known for his informal and generous attitude towards students. He was always kind to a fault. I have a personal anecdote to narrate here. In 1964 at the Tekkalakota excavation where Dr. Ansari was the Field Director, in the trench I was asked to supervise one of the workmen while digging a new layer struck his pickaxe against an adult human skull and nearly broke it. On realising what had happened I was terrified and mentally prepared myself to receive a severe reprimand, particularly in view of the fact that Prof. Sankalia was also present. When I told Dr. Ansari about the mishap, far from being furious, he quietly told me that such mishaps sometimes do occur and that the best way of minimising them is to remember the dictum that one should always be prepared to find the unexpected beneath the soil. This advice indeed stood me in good stead in the three decades of my own field research covering both explorations and excavations. Dr. Ansari's words certainly came alive in 1994 when we exposed with perfection several pot-burials of infants, and that too, badly preserved ones at the Neolithic site of Budihal in Karnataka.

Dr. Ansari was a very good classroom teacher too. His lectures were noted for their lucid and direct style. He often used to illustrate his lectures by skillful sketches and figures on the blackboard. This inevitably leads us to another important contribution made by Dr. Ansari to the Department. The drawings of maps, objects and structures printed in the various publications of the Institute won reviewer's praise on more than one occasion, and a large share of credit for this achievement would rightly be Dr. Ansari's. He trained an enthusiastic band of technicians in photography and the specialized drawing of archaeological artefatcs. Shri Girme and Shri V.K. Nagpure (both photographers) and Shri S.K. Kulkarni, Shri C.G. Padwal, Shri Y.S. Rasar, Shri P.R. Kulkarni, Shri R.B. Sapre, Shri R.B. Warke and Dr. P.S. Joshi (all draughtsmen) truly revered Dr. Ansari as their *Guru*.

Dr. Ansari was a man of simplicity, humility and politeness. He was soft-spoken and straightforward in his interpersonal relationships. These qualities endeared him to his colleagues and students alike and made him an *Ajatasatru* (the one who has no enemies).

Dr. Ansari gave informal research guidance to all the students of the Department enrolled for their doctorate on various topics, particularly in prehistory and protohistory. His advice and suggestions were eagerly sought by students in matters like stone tool and pottery classification. They benefited enormously from his experience of replicating stone tools and his wide knowledge of present-day pottery-making traditions in India. In 1984, Shri S.P. Tampi successfully completed a Ph.D. thesis entitled "Prehistoric Archaeology of South Kerala with Special Reference to the Valley of Anjunad" under the guidance of Dr. Ansari.

With his own salary as the only source of income, Dr. Ansari successfully managed a fairly large family consisting of four sons and two daughers, and spared no sacrifice for their sake. All of them in turn loved him and took good care of him till his death.

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General Secretary's Report — 1997-98

As in past years this year has also been quite gratifying both academically and financially with the regular activities of the Society carried out satisfactorily. The financial position remains reasonably sound because of the availability of annual grants from the Archaeological Survey of India and the Indian Council of Historical Research for the publication of the Journal and from the latter for organizing the Annual Conference. The sale of the Journal continues to increase both in India and abroad. The accounts of the Society for 1997-98 could not be audited in time because of the personal problems of our auditor. The audited statement of accounts will therefore, appear in the December issue of the Journal.

Man and Environment

This is the ninth year of the biannual publication of the Journal, and its circulation continues to grow steadily. The quality of the Journal is steadily improving, as reflected in the wide range of articles contributed by scholars both within and outside the country.

We would like to acknowledge the sincere help of Mr. Sujit Patwardhan and his staff at Mudra Press.

The Annual Conference

The XXV Annual Conference of the Society was held under the auspices of the Department of History, Ancient Indian History, Culture and Archaeology, H.N.Bahuguna Garhwal University, Srinagar (Garhwal), Uttar Pradesh from 16 to 18 October, 1997, in conjunction with the annual conferences of the Indian Archaeological Society and the Indian History and Culture Society.

The following members participated in the conference:

R.C. Agrawal, P. Ajithprasad, Naseem Ameer, U.P. Arora, R.S. Bisht, Subrato Chakrabarti, P.P. Dandawate, S.G. Deo, B.C. Deotare, K.N. Dikshit, Kiran Dimri, A.S. Gaur, Savita Ghate, S.P. Gupta, R.V. Gurjar, Kirti Jain, P.P. Joglekar, K.J. John, J.P. Joshi, M.D. Kajale, Jeevan S. Kharakwal, R. Korisettar, Anupama Kshirsagar, Arun Kumar, Bhamini Mahida, Abhijit Majumdar, V.D. Misra, Anup Mishra, V.N. Misra, R.K. Mohanty, Arati Deshpande-Mukherjee, Malti Nagar, Amarendra Nath, Jeetendra Nath, K.P. Nautiyal, Vinod Nautiyal, J.N. Pal, Shanti Pappu, R.K. Pancholi, J.N. Pandey, Preeti Amar Panjwani, P. Vijaya Prakash, Dilip Rajgor, B.David Raju, M.D.N.Sahi, V.G. Sathe, T.C.Sharma, Sukanya Sharma, Lajwanti Shahani, V. Selvakumar, V.S. Shinde, K. Srinivasulu, V.H. Sonawane, P.K. Thomas, Saji Thomas, Alok Tripathi, D.N. Tripathi, Vibha Tripathi, R.K. Varma and W. Jamir.

The conference was inaugurated by Prof. B.P. Sinha in the morning of 16th October. Prof. K.P. Nautiyal, Vice Chancellor, H.N. Bahuguna Garhwal University, presided over the function. Prof. V.N. Misra welcomed the guests. He gave a brief account of the history of the Society, its activities and its relationship with the other two societies. Prof. B.P.Sinha gave the inaugural address on recent developments in Indian archaeology. Dr. B.S. Grewal, Pro-Vice Chancellor, H.N. Bahuguna Garhwal University, proposed a vote of thanks on behalf of the organisers.

After the inaugural function the presidential addresses of the three societies were delivered. Dr. Bridget Allchin, President of our Society, presented her address on "Whither South Asian Archaeology?" which is published in this volume.

The academic sessions of the conference were held on the afternoon of the 16th and on 17th and 18th October.

The following papers were presented in the Conference.

P. Ajithprasad: Palaeolithic Settlements in Jogpura

J.N. Pal: Recent Exploration of Palaeolithic Culture near Kerwa Dam, Bhopal, Madhya Pradesh

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J.S. Kharakwal: The Archaeology of Uttarakhand

B. Tripathy and P.P. Joglekar: Archaeological Investigations in the Middle Mahanadi Valley, Central Orissa

P.P. Dandawate: Little Known Ardhanari Images of Brahmanical Deities

B. Tripathy: Early Historic Trade in Central and Western Orissa: an Ethnoarchaeological Perspective

The Professor H.D. Sankalia Memorial Lecture

The Professor H.D. Sankalia Memorial Lecture for 1997 was delivered by Prof. Raymond Allchin of the University of Cambridge (U.K.). on 16th October, 1997 during the Society's conference at Srinagar. The topic of Prof. Allchin's lecture was 'Interface of History and Archaeology'. The Lecture is published in this issue of the Journal.

The Professor H.D. Sankalia Memorial Young Archaeologist Award

Two papers were received for this award and were recommended for presentation by the referees. Both the papers were presented at the Srinagar Conference. They were:

Dilip Rajgor's "Rediscovering the Janapada Punch-marked Coins of Early Historic India", and Arati "Shell fishing and Shell Craft Activities During the Harappan

Period with Special Reference to Gujarat".

Judges panel comprising Prof. B.P. Sinha and Prof. K.M. Srivastava unanimously recommended that the award be given to Dr. Rajgor for his paper. Dr. Rajgor's as well as Dr. Deshpande-Mukherjee's papers are published in this issue of the Journal.

The Dr. Malti Nagar Ethnoarchaeology Award

This year no paper received for this award.

At the concluding session of the Conference held in the evening of 18th October, warm thanks were given to Dr.B.M. Khanduri and Dr. Vinod Nautiyal, local secretaries of the Conference, as also to Prof. K.P. Nautiyal, Vice-Chancellor of the University, for their excellent arrangements and warm hospitality extended to the delegates.

Life Members

Our family of Life Members of the Society has now been joined by:

1. Mr. Tapan Kumar Das, 2. Dr. Binodini Devi,
3. Dr. Manoj Kumar Kurmi, 4. Dr. Dilip Rajgor, and
5. Mr. W. Jamir.

The total number of Life Members now stands at 359.

Three Life Members of the Society, namely Dr. Shashi Asthana, Dr. Y.B. Singh and Prof. Shankar Tewari, passed away during the year.

Meetings of the Executive Committee

A meeting of the Executive Committee was held on 14th March 1997 at 4.00 p.m in the Society's office in the Department of Archaeology, Deccan College, Pune.

The following members were present:

1. Prof. V.N. Misra, 2. Dr. P.K. Thomas, 3. Dr. Statira Wadia, 4. Dr. R.K. Mohanty, 5. Dr. P.P. Joglekar, 6. Dr. V.S. Shinde, 7. Dr. Sheila Mishra, and 8. Dr. P.P. Dandawate.

In the absence of the Chairman, Prof. A. Sundara and the Vice-Chairman, Prof. V.D. Misra, Prof. V.N. Misra, General Secretary, presided over the meeting. The following matters were discussed and resolutions passed.

Prof. Misra read out the letter and the draft of the Agreement, from Prof. R.K. Sharma regarding his proposed donation to the Society for instituting an award in his name to be given every year to an eminent archaeologist. The Committee carefully considered the clauses in the draft Agreement and made the following observations which the General Secretary was requested to communicate to Prof. Sharma.

Clause 4.

1. The process of Award giving, includes other related expenses- such as correspondence, meetings for the selection, the Award ceremony, T.A. and D.A. and hospitality to the awardee etc.

Clause 6.

1. The interest rates fluctuate. Hence, a deposit of Rs. 1,05,000.00 may not provide the necessary amount specified for this award every year along with the necessary related expenses mentioned above.
2. The award amount mentioned is unrealistic and does not include overhead expenses such as maintenance of the accounts, their auditing, etc.
3. A minimum of 10% of the total annual return should be set aside for maintenance.

Clause 8.

1. The amount for the Award as specified may seem impressive at the moment, but will look increasingly meagre in the years ahead.
2. The management of the fund and arrangements for the Award ceremony will probably consume half of the annual returns available.
3. A part (10%) of the annual return should merge with the corpus, to maximize the return in years to come.
4. The Committee feels that if the Award is given every year the prestige of the Award may not be maintained.
5. The Committee proposes that the Award should be given every three years. The amount of the Award each time to be decided by the committee.

The meeting ended with a vote of thanks to the Chair.

Meeting of the General Body of the Society

The General Body Meeting of the Society was held at the Department of History, Ancient Indian History, Culture and Archaeology, H.N. Bahuguna Garhwal University, Srinagar (Garhwal) at 11 a.m on 16th October, 1997.

The following members were present:

R.C. Agrawal, P. Ajithprasad, Naseem Ameer, U.P. Arora, R.S. Bisht, Subrato Chakrabarti, P.P. Dandawate, S.G. Deo, B.C. Deotare, K.N. Dikshit, Kiran Dimri, A.S. Gaur, Savita Ghate, S.P. Gupta, R.V. Gurjar, Kirti Jain, P.P. Joglekar, K.J. John, J.P. Joshi, M.D. Kajale, Jeevan S. Kharakwal, R. Korisettar, Anupama Kshirsagar, Arun Kumar, Bhamini Mahida, Abhijit Majumdar, V.D. Misra, Anup Mishra, V.N. Misra, R.K. Mohanty, Arati Deshpande-Mukherjee, Malti Nagar, Amarendra Nath, Jeetendra Nath, K.P. Nautiyal, Vinod Nautiyal, J.N. Pal, Shanti Pappu, R.K. Pancholi, J.N. Pandey, Preeti Amar Panjwani, P. Vijaya Prakash, Dilip Rajgor, B. David Raju, M.D.N. Sahi, V.G. Sathe, T.C. Sharma, Sukanya Sharma, Lajwanti Shahani, V. Selvakumar, V.S. Shinde, K. Srinivasulu, V.H. Sonawane, P.K. Thomas, Saji Thomas, Alok Tripathi, D.N. Tripathi, Vibha Tripathi, R.K. Varma and W. Jamir.

The meeting was presided over by Prof. B.P. Sinha in the absence of Prof. A. Sundara, Chairman of the Society.

The following business was transacted at the meeting.

The report of the activities of the Society for the year 1996-1997 was presented by Prof. V.N.Misra, General Secretary of the Society. It was unanimously approved by the members present.

The annual Audited Statement of Accounts for the year 1996-97 was placed before the General Body by the General Secretary and it was unanimously approved by the members present.

The proposed donation by Prof. R.K. Sharma to the Society for instituting an Award in his name to be given every three years to an eminent Archaeologist was placed before the General Body by the General Secretary and it was unanimously approved by the members present along with the conditions which the Society had put forward.

It was unanimously accepted that those who are not getting the Journal regularly (which is sent under Certificate of Posting) can get the Journal by Registered Post by paying a one time sum of Rs. 400/-.

President of the Society for 1997

Prof. V.N. Misra proposed the name of Prof. D.N. Tripathi as President of the Society for 1997-98 The proposal was unanimously accepted by the members present.

Professor H.D. Sankalia Memorial Lecturer

Prof. V.N. Misra proposed the name of Shri J.P. Joshi as the Professor H.D. Sankalia Memorial Lecturer for 1997-98. The proposal was unanimously accepted by the members present.

The meeting ended with a vote of thanks to the Chair.

(V.N. Misra)
General Secretary

30th November 1997

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Journal of the
Indian Society for
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Volume XXIII, Number 2 (July-December 1998)

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Joint Secretary	P.K. Thomas
Assistant Secretary	R.K. Mohanty
Treasurer	P.P. Dandawate

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P.P. Joglekar
V.H. Sonawane
Subrata Chakravarti
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D.N. Tripathi
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Giriraj Kumar
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Life South Asia – Rs. 2000/- Other Countries – US $ 300

The subscription amount should be sent to the General Secretary of the Society (but not in his personal name). It should be a Bank Draft payable to the Indian Society for Prehistoric and Quaternary Studies and drawn on any nationalized bank which has a branch in Pune. Money Orders/Postal Orders/Cheques will not be accepted.

Change of address should be immediately communicated to the General Secretary to ensure prompt despatch and safe delivery of the Journal, conference circulars, etc.

Editorial

Four papers in the present issue relate to different aspects of Megalithic studies. These vary from the report on the living megalithic traditions of the Anals of Manipur and the geomorphic alterations to a Megalithic site in Andhra Pradesh (Isunuru) to the excavations of the site of Kodumanal in Tamil Nadu and relationships between landscape, megaliths and societies in the Upper Palar basin of Tamil Nadu. These papers all differ greatly in their approach to Megalithic studies and show the richness and diversity of the current research in this field.

A Mesolithic site from the Eastern Ghats in Andhra Pradesh is reported in the paper by Vijay Prakash. Detailed typological and technological analysis of the microblade industry from Watgal in Karnataka once more investigates a relatively less studied aspect of the Neolithic culture and adds valuable new information.

Further details of the archaeological material from Bet Dwarka Island are given by Sandaresh and Gaur. Bednarik presents a very interesting case for the archaeological importance of beads and pendants, arguing for their presence right back into Lower Palaeolithic times. Ratnagar makes a detailed critique of some of the interpretations made recently on the basis of studies of ancient human skeletons. Choksi details how market forces affect pottery manufacture in the context of two different contemporary pottery making groups in Gujarat. A Report on the National seminar on River Valley cultures of India held at Indira Gandhi Rashtriya Manav Sangrahalaya, Bhopal gives an account of an important seminar held this year whose proceedings are expected to be published shortly. Shanti Pappu's interview with the Allchins, the pre-eminent British authorities on the Archaeology of South Asia, will provide interesting information to our readers.

We regret the long delay in bringing out this issue and assure our readers that this is an exception. The next issue, which is a special issue devoted to the proceedings of a workshop on Palaeoclimatic Records of Arid and Semi-Arid Regions During the Late Quaternary held at Deccan College, Pune in December 1998 is expected to be on schedule. This was the Third workshop of IGCP-349 (Paleomonsoons and Desert Margins) and First workshop of IGCP-413 (Understanding Future Dryland Environmental Changes from Past Dynamics).

The publication of this Journal has been financially supported by the Indian Council of Historical Research (ICHR) and Archaeological Survey of India (ASI). The responsibility for the facts stated, opinions expressed, or conclusions reached is entirely that of the contributors of the articles. The ICHR and ASI accept no responsibility for them.

Vangasari: a Mesolithic Cave in the Eastern Ghats, Andhra Pradesh

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Abstract

Mesolithic cultural evidence, though profuse in the coastal plains on the east coast of India, is scanty in the hill tracts of the Eastern Ghats, which run adjacent to the plains and almost parallel to the east coast. Among a few Mesolithic sites discovered a small cave at Vangasari (VGSR-C1) is the richest not only in terms of the number of microlithic tools (3157), their concentration in an 18 sq m cave floor area, but also the associated cultural objects like saddle querns, a ringstone, hood-stones, and semi-fossilised bone pieces. The statistical analysis and the frequency distribution of the tool types against their place of recovery (18 sq m blocks) have shown the spatial organisation of tool fabricating spots in the cave itself.

Introduction

The hill tracts which form the western portion of Visakhapatnam District are a part of the Eastern Ghats comprising Khondalites of Precambrian age. On an average they have a height of 800 m though individual peaks rise to heights of 1500 to 1600 m. The area, covered with dry deciduous forest, has an annual precipitation of 1000-1600 mm. Summers are cool and the winters are chilly. The area is inhabited by several tribal populations.

At the macro level, the Ghats appear to be homogeneous, but at the micro level a wide range of variation can be noticed. The hills and hill ranges are demarcated into localised topographical features such as local hill streams and their channels. One such hill range, locally known as 'Gurralakonda' hill range (the horse hill), is an isolated range, being separated by the Peddagedda (big stream) and Chinnagedda (small stream), which are part of the drainage of the Sileru River, a tributary of the Godavari.

The Gurralakonda hill range with a length of 8 km and breadth of 3 km runs in a south-north, and about 12 hills form together a range with heights between 839 m to 1145 m AMSL. The slope is from southwest to southeast. The northern portion of the range is more than 1000 m height while the southern part is less than 839 m. A hill with a height of 1145 m on the west gently slopes towards the east (839 m). It has three caves facing towards the south and southeast of the hill range. (The gently sloping pattern of the hill continues till the Peddagedda stream, which flows in a south-north direction). The caves are located between the 839 m and 915 m contours. They are neither deep nor very wide. The caves measure on an average 12 m on horizontal and 5 m on vertical plane, and are about 4 m deep from the entrance. They are referred to as VGSR-C1, VGSR-C2 and VGSR-C3, after the tribal village of Vangasari (VGSR) located about 1.5 km from the caves.

VGSR-C1

The Vangasari Cave 1 (VGSR-C1) is located on the left side of the Chintapalli-Lammasingi ghat road, where it crosses the Peddagedda stream (Fig. 1). The front portion of the cave is like a terrace slope towards the stream. The cave is 9.3 m wide and 2.5 m high. It tapers down on both the sides, leaving a lenticular opening. The front portion of the cave, though wide tapers towards the interior with a width of about 50 cm in the central portion. The maximum floor length of the cave in the interior is about 4 m.

VGSR-C2

This small cave measures 6.6 m on the horizontal and 2.1 m on the vertical plane with an interior length of 1.4 m and is located about 60 m southwest and at an elevation of 30 m above VGSR-C1. The cave resembles a step-like rock-cut bench and its floor is a hard rock surface. No archaeological material was noticed on the cave floor. However, the scrapped sections of the sediment between the cave and the Peddagedda stream revealed a few microliths.

VGSR-C3

A large cave measuring 21 m on the horizontal and about

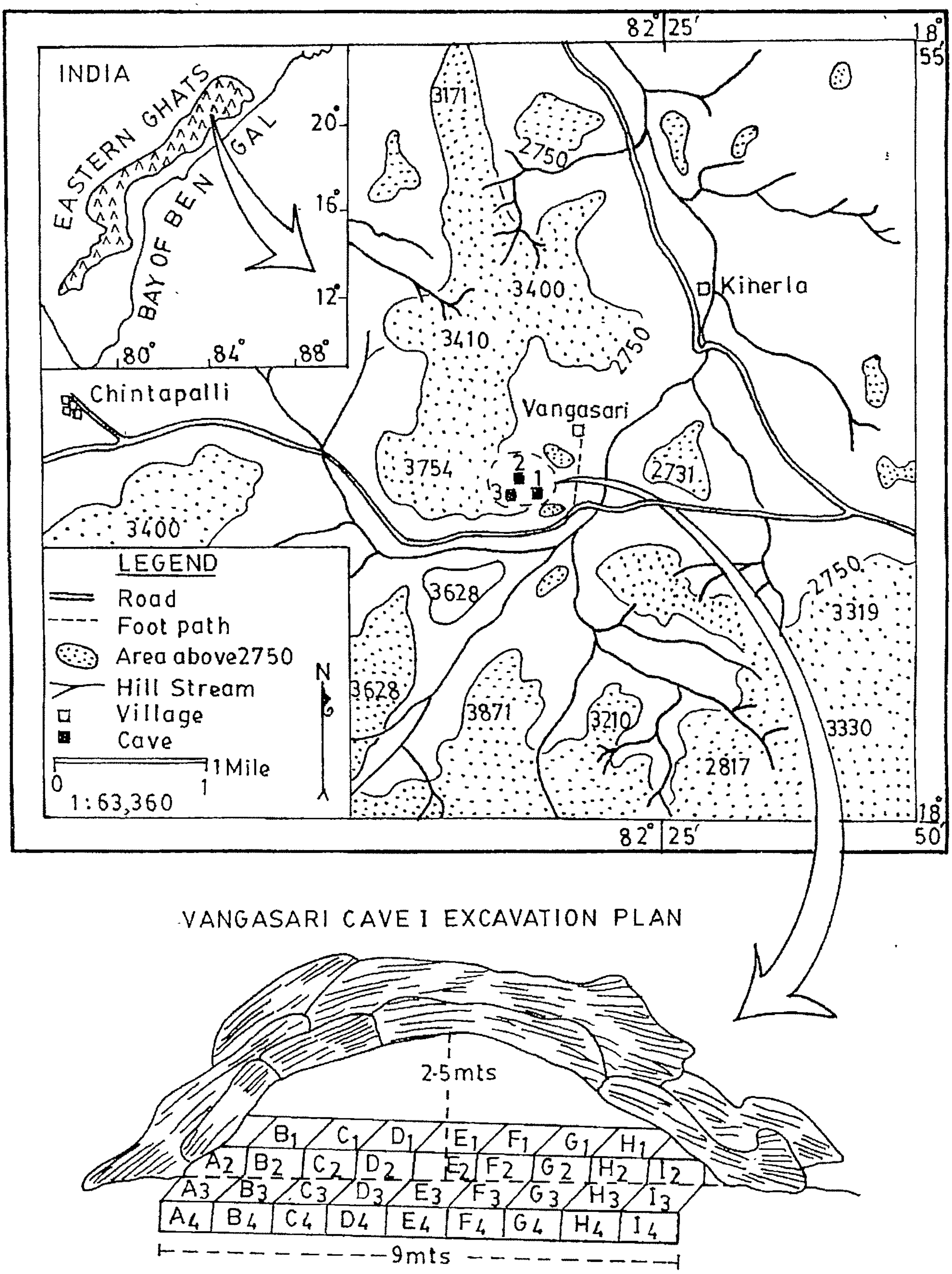


Fig. 1: Map showing the location of Vangasari caves and excavation plan

7 m on the vertical plane with an interior length ranging between 3 m and 5 m. It is located about 10 m above VGSR-C2. The cave floor is a hard rock surface with a few rock pieces. The sediment between VGSR-C3 and VGSR-C2 is like a colluvial fan deposit with breccia and is colonised by trees and twiners.

The VGSR-C2 and VGSR-C3 seem to be ideal places for habitation but lack any accumulation of sediments due to their steepness and elevation.

Excavation

A part of the cave VGSR-C1, located on Gurralakonda was excavated. The cave floor was divided into one sq m blocks which were identified both with a letter and a numeral, respectively denoting the horizontal and vertical planes. e.g. A1, B2, C4, E3, H4, etc., (Fig. 1).

The top layer of the floor consists of ash, cinders, half burnt fuel wood, maize corns, and sheep and goat dung. After removal of the top layer a pebbly bed was exposed. The pebble concentration is greater towards the left portion of the cave. This pebbly layer was partly exposed by rain wash near the ceiling edge before excavation.

A total of 18 sq m of floor area has been excavated, and in all the squares the material, either natural or artificial, is of the same variety and quality but varies in quantity. Even the sediment does not show much variation. The thickness of the deposit is not more than 35 cm in any of the excavated units when rock, perhaps fallen from the roof was encountered. The depth of sediment was almost uniform except towards the left corner of the cave, where the excavation did not touch the stone blocks in B4, C4 and C3, but a hard soil layer. The sediment is a light brown silty soil. The overall depth of the deposit was about 15cm between horizontal lines 1 and 2, about 20 cm between 2 and 3, and about 35 cm between 3 and 4. Thus, the thickness of the sediment was about 20 cm inside the cave and it gradually increases to about 35 cm at the outer edge of the cave floor. The pebbles coupled with microliths, and other associated materials such as a ringstone, grounded stone blocks and more interesting objects like ground hood-stones are more frequent towards the left portion of the cave.

Artefact Analysis

The excavated material was marked after the trench numbers and accordingly analysed for various archaeometric characters. All the material was classified into finished forms, associated objects and biproducts. The finished forms and the associated objects are presented in this paper, ignoring the biproducts which run into a few thousands.

Finished Forms

A total of 3157 tools were recovered from 18 blocks of one sq m each and classified into 10 tool types based on their technomorphic characters (Table 1).

The 3157 artefacts are classified into backed blades (353), retouched blades (294), simple blades (369), points on blades (449), broken blades (356), irregular blades (214), borers (201), burins (118), scrapers (502) and points on flakes (301). Blocks C3, C4 and B4 had a larger number of artefacts followed by E3, F4, F2, D3, E2 and G3. Blocks D2, H4, F3, G4 and H2 have the least number of artefacts. The remaining blocks are moderately represented between the highest and the least (H3, E4, D4 and G2).

Scrapers (15.90%) and points on blades (14.22%) are the dominant tool types, but the blade element represented in the categories of backed blades (11.18%), retouched blades (9.31%), simple blades (11.69%) and broken blades (11.28%) account for 43.46 per cent. Points on blades are in fact part of the blade element but for their techno-functional characteristic. The burin is a tool type has limited occurrence (3.74%). The other tool types are borers (6.37%) and points on flakes (4.82%).

Backed Blades

Backed blades are the most deliberately shaped artefacts. They can act as an index to quantify the technological refinement of the stone tool technology. 353 backed blades have been recovered from the VGSR-C1 assemblage . They are further categorised into different sub-types based on their blunting and morphological parameters (Table 2).

Table 2 shows that out of 353 backed blades 165 are backed points (46.74%), 77 backed knives (21.81%), 55 lunates (15.58%) and 10 triangles (2.83%), the remaining 46 are categorised into broken backed blades (13.04%) (Fig: 2: 1-45).

Most of the backed blades measure 10 to 20 mm in length, 2 to 10 mm in breadth and 2 to 4 mm in thickness. The longest backed blade in the collection measures 37 mm while the smallest measures 9 mm. Most of the backed blades are fresh and a few have broken tips. The backed points and backed knives are slightly longer than the lunates and triangles. Both the ends of the lunates and triangles are pointed and sharp, while on points and knives one end is sharp and pointed but the other end is invariably thick, and on many examples the striking platform and the bulb of percussion are prominent.

Retouched Blades

Retouched blades number 294 accounting for 9.31 per cent of the total collection of VGSR-C1. The retouched blades are thin, slender and they range between 10-40 mm in length, 3-10 mm in breadth and 2-4 mm in thickness.

Table 1: Tool type, block and raw material wise distribution of artefacts, VGSR–C1.

S.No.	Tool Type	B4	C3	C4	D2	D3	D4	E2	E3	E4	F2	F3	F4	G2	G3	G4	H2	H3	H4	Total	%
1.	Backed Blades	19 (5)	43 (13)	42 (21)	11 (5)	23 (10)	5 (1)	35 (16)	41 (14)	6 (2)	37 (6)	13 (4)	26 (13)	4 (2)	25 (8)	1 (0)	0	16 (5)	6 (2)	353 (127)	11.18 (4.02)
2.	Retouched Blades	24 (13)	16 (3)	29 (23)	15 (4)	31 (7)	7 (3)	23 (3)	32 (6)	1 (1)	32 (8)	9 (5)	19 (12)	5 (3)	22 (8)	2 (1)	8 (6)	12 (6)	7 (7)	294 (119)	9 31 (3.77)
3.	Simple Blades	59 (25)	27 (5)	27 (9)	14 (5)	37 (11)	8 (5)	29 (9)	42 (6)	5 (0)	39 (8)	7 (4)	19 (6)	10 (1)	18 (3)	2 (1)	1 (0)	22 (6)	3 (6)	369 (104)	11.69 (3.29)
4.	Points on Blades	59 (23)	37 (14)	50 (19)	12 (6)	29 (12)	23 (5)	40 (14)	54 (37)	11 (3)	41 (21)	8 (4)	25 (10)	6 (1)	20 (7)	5 (2)	1 (0)	21 (6)	7 (4)	449 (188)	14 22 (5.96)
5.	Broken Blades	40 (15)	34 (8)	44 (18)	10 (4)	21 (10)	14 (6)	15 (3)	12 (3)	15 (5)	16 (7)	3 (1)	41 (18)	17 (1)	29 (9)	4 (0)	5 (3)	33 (21)	3 (2)	356 (134)	11 28 (4.25)
6.	Irregular Blades	18 (8)	43 (22)	10 (2)	3 (2)	8 (3)	9 (1)	9 (4)	15 (6)	10 (2)	6 (3)	2 (1)	28 (10)	8 (3)	15 (4)	3 (0)	4 (2)	13 (5)	10 (2)	214 (180)	6 78 (2 53)
7.	Borers	23 (7)	25 (11)	14 (3)	8 (3)	21 (8)	7 (1)	10 (6)	26 (6)	18 (4)	18 (6)	3 (0)	6 (2)	8 (10	3 (2)	1 (1)	4 (0)	11 (6)	5 (3)	201 (71)	6.37 (2.25)
8.	Burins	17 (9)	18 (10)	14 (4)	3 (0)	5 (0)	3 (2)	4 (1)	8 (0)	4 (2)	5 (1)	0	3 (2)	3 (1)	15 (8)	2 (1)	2 (0)	7 (6)	5 (2)	118 (49)	3 74 (1 55)
9.	Scrapers	37 (21)	61 (13)	54 (18)	7 (3)	17 (7)	40 (22)	19 (7)	19 (5)	53 (15)	19 (5)	2 (1)	47 (34)	30 (10)	35 (15)	13 (6)	9 (4)	24 (11)	16 (7)	502 (211)	15.90 (6.68)
10.	Points on Flakes	14 (6)	37 (18)	33 (13)	6 (3)	15 (7)	9 (2)	20 (110	22 (11)	14 (40	21 (11)	4 (2)	38 (22)	13 (7)	20 (9)	3 (3)	1 (1)	26 (19)	5 (3)	301 (152)	9.53 (4.82)
 ( )	Total Indicate Quartz	310 (132)	341 (117)	317 (130)	89 (135)	206 (75)	125 (48)	204 (74)	271 (95)	127 (38)	234 (76)	51 (22)	252 (129)	104 (30)	202 (73)	36 (15)	35 (16)	185 (98)	67 (32)	3157 (1235)	100.00 (39.12)
 ( )	Per cent Indicate Quartz	9.82 (4.18)	10.80 (3.70)	10 04 (4.12)	2.82 (1.12)	6.56 (2.38)	3.96 (1.52)	6.46 (2.34)	8 58 (3.01)	4.02 (1 20)	7.41 (2 40)	1.62 (0.70)	7.98 (4.09)	3.29 (0.95)	6.41 (2 31)	1.14 (0.48)	1.11 (0.51)	5 86 (3.10)	2.12 (1.01)	100.00 (39.12)	

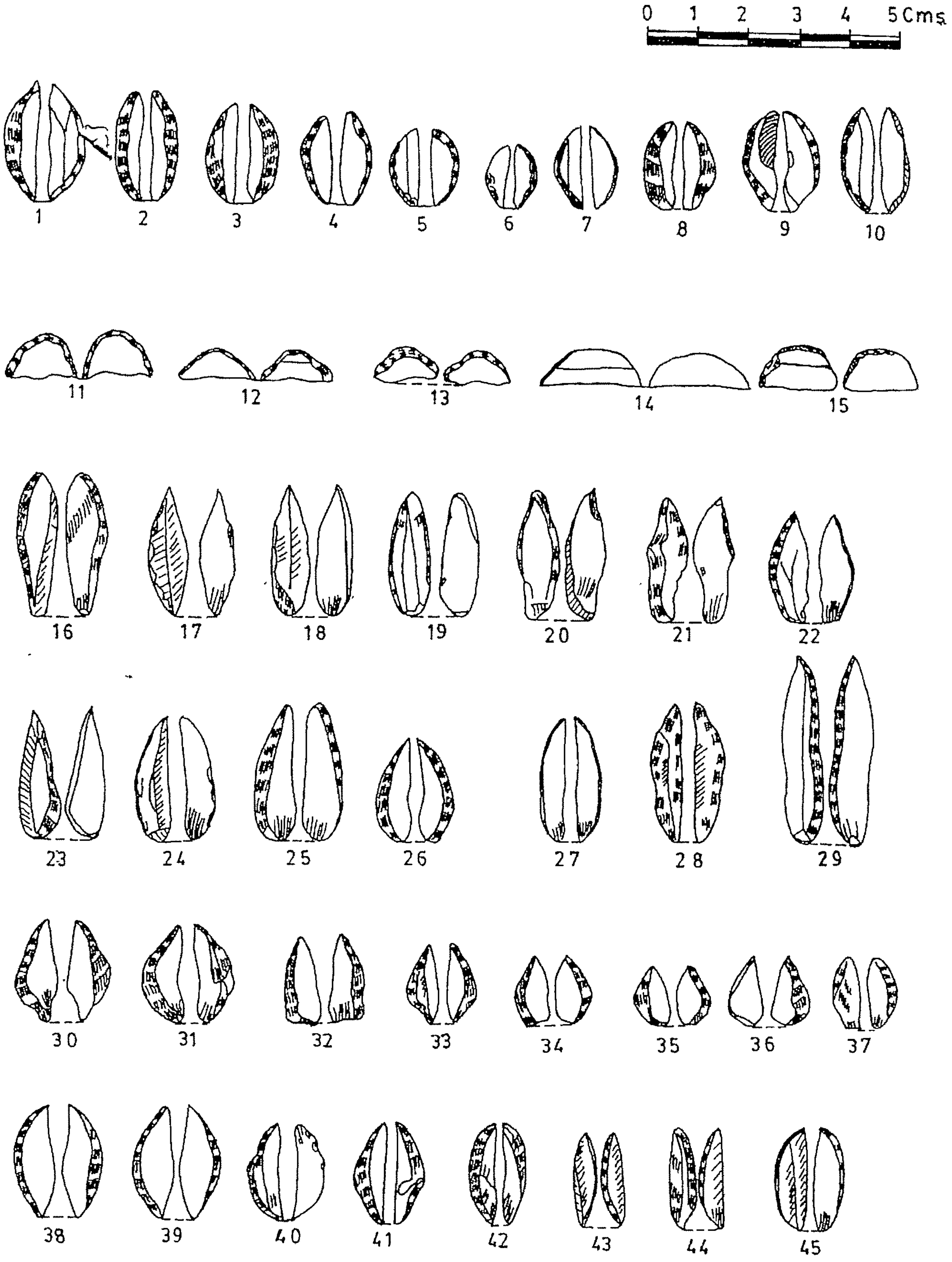


Fig. 2. Backed blades: 1-10 lunates, 11-15 triangles, 16-29 backed points, 30-45 backed knives

Table 2: Sub-types of backed blades: block and raw material wise distribution

S.No.	Sub-types	B4	C3	C4	D2	D3	D4	E2	E3	E4	F2	F3	F4	G2	G3	G4	H2	H3	H4	Total	%
1.	Lunates	5 (1)	5 (1)	16 (7)	0	4 (2)	0	3 (0)	5 (1)	1 (0)	4 (10	1 (0)	2 (1)	0	4 (2)	0	0	3 (0)	2 (1)	55 (17)	15.50 (4.82)
2.	Triangles	1 (0)	1 (0)	3 (3)	0	1 (3)	0	0	0	0	1 (0)	1 (0)	1 (1)	0	1 (1)	0	0	0	0	10 (5)	2.83 (1.42)
3	Backed Points	7 (2)	22 (8)	12 (8)	3 (2)	13 (6)	2 (0)	19 (8)	21 (10)	2 (0)	18 (1)	8 (30	15 96)	2 (1)	11 (3)	1 (0)	0	7 (3)	2 (1)	165 (62)	46.74 (17 56)
4	Backed Knives	5 (2)	9 (2)	6 (2)	4 (2)	2 (1)	3 (1)	8 (4)	9 (2)	2 (2)	11 (3)	3 (1)	5 (3)	1 (1)	5 (1)	0 (2)	0	2 (1)	2 (0)	77 (28)	21.81 (7 93)
5.	Broken	1 (0)	6 (2)	5 (1)	4 (1)	3 (1)	0	5 (4)	6 (1)	1 (0)	3 (1)	0	3 (2)	1 (0)	4 (1)	0	0	4 (1)	0	46 (15)	13.04 (4.25)
	Total	19 (5)	43 (13)	42 (21)	11 (5)	23 (10)	5 (1)	35 (16)	41 (14)	6 (2)	37 (6)	13 (4)	26 (13)	4 (2)	25 (8)	1 (0)	0	16 5	6 (2)	353 (27)	100 00
 ( )	Per cent Indicate Quartz	5.38 (1 42)	12.18 (3.68)	11.90 (5 95)	3.12 (1.420	6 52 (2 83)	1.42 (0.28)	9.92 (4.53)	11.61 (3.96)	1 70 (0 57)	10.48 (1.70)	3 68 (1.13)	7 37 (3 68)	1.13 (0 57)	7.08 (2 27)	0.28 –	0 –	4.53 (1.42)	1.70 (0.57)		 (35.98)

Table 3: Sub-types of scrapers: block and raw material wise distribution

S.No.	Sub-types	B4	C3	C4	D2	D3	D4	E2	E3	E4	F2	F3	F4	G2	G3	G4	H2	H3	H4	Total	%
1.	Single side	12 (8)	10 (2)	12 (5)	6 (2)	5 (2)	7 (4)	6 (2)	10 (3)	12 (4)	5 (2)	1 (1)	14 (12)	5 (1)	8 (3)	3 (1)	1 (1)	6 (3)	2 (1)	125 (37)	24.90 (11.35)
2.	Double side	10 (5)	15 (4)	13 (3)	1 (1)	5 (2)	7 (4)	8 (3)	3 (1)	10 (2)	4 (0)	1 (0)	12 (7)	8 (2)	11 (7)	4 (3)	3 (1)	6 (5)	3 (1)	124 (51)	24.70 (10.16)
3	Notched	5 (3)	3 (0)	10 (4)	0	4 (2)	9 (4)	2 (1)	1 (0)	6 (1)	2 (1)	0	4 (2)	3 (0)	3 (0)	1 (1)	0	6 (5)	5 (2)	64 (26)	12.75 (5.18)
4	Convex	4 (2)	10 (3)	5 (3)	0	1 (0)	7 (3)	0	2 (0)	7 (3)	3 (0)	0	8 (8)	6 (3)	8 (3)	1 (0)	4 (2)	3 (3)	4 (3)	73 (36)	14.54 (7.13)
5.	End	2 (1)	11 (2)	6 (0)	0	2 (1)	4 (4)	3 (1)	3 (1)	3 (1)	3 (0)	0	5 (4)	4 (3)	1 (1)	2 (1)	1 (0)	1 (0)	1 (0)	52 (21)	10.36 (4.18)
6.	Borer cum end	4 (2)	12 (2)	8 (2)	0	0	6 (3)	0	0	15 (4)	2 (2)	0	4 (1)	4 (1)	4 (1)	2 (0)	0	2 (2)	1 (0)	64 (21)	12.75 (4.18)
	Total	37 (21)	61 (13)	54 (18)	7 (3)	17 (7)	40 (22)	19 (7)	19 (5)	53 (15)	19 (5)	2 (1)	47 (34)	30 (10)	35 (15)	13 (6)	9 (4)	24 (18)	16 (7)	502 (211)	100.00 (42.22)
 ( )	Per cent Indicate Quartz	7.37 (4.18)	12.15 (2.59)	10.76 (3.59)	1.39 (0.06)	3.39 (1.39)	7.97 (4.38)	3.78 (1.39)	3.78 (1.00)	10.56 (3.00)	3.78 (1.00)	0.40 (0.20)	9.36 (6.77)	5.99 (1.99)	6.97 (3.00)	2.59 (1.20)	1.79 (0.80)	4.78 (3.59)	3.19 (1.39)	100.00	 (42.22)

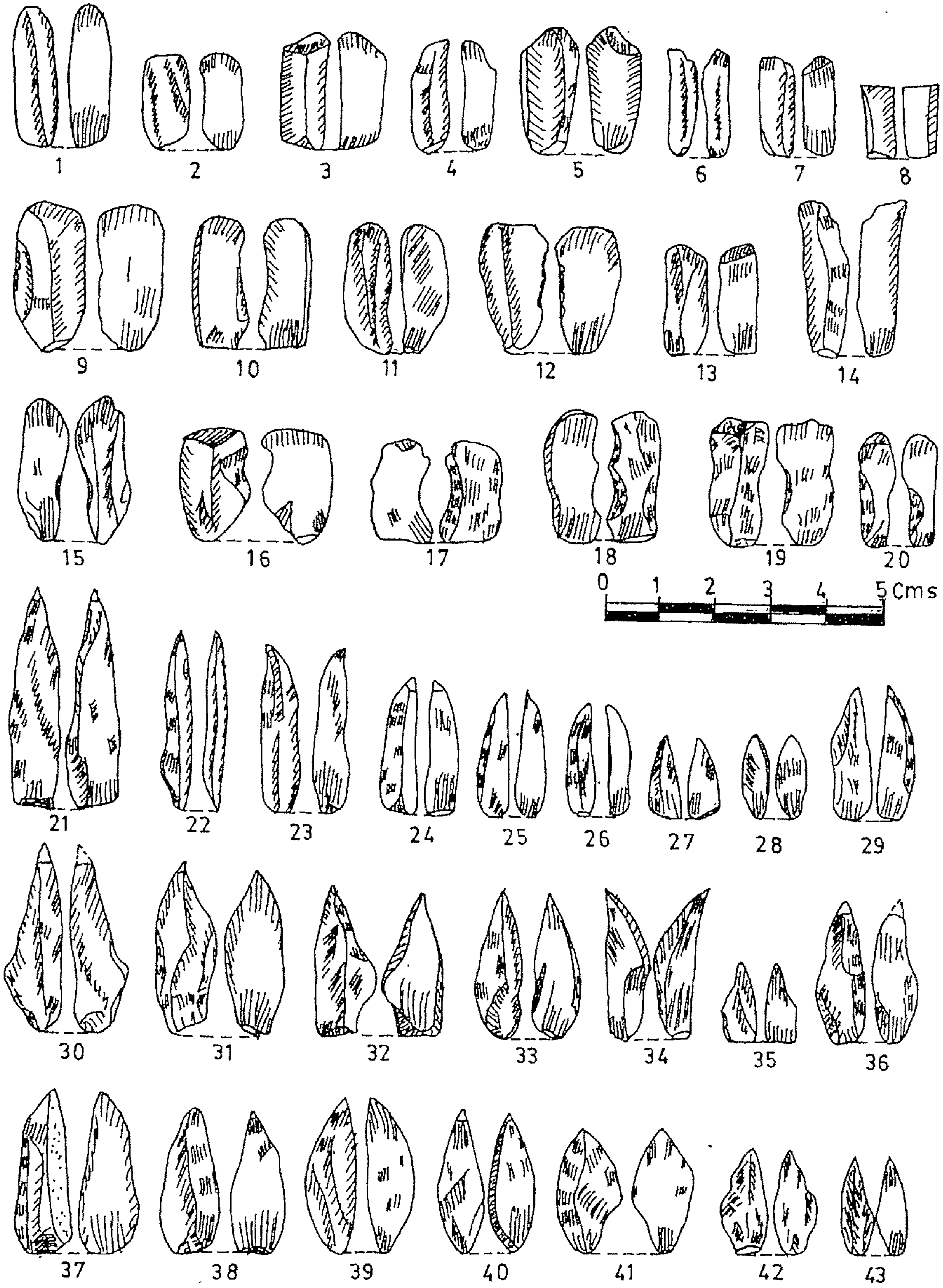


Fig. 3: Microlithic tools. 1-8 simple blades, 9-14 retouched blades, 15-20 notched blades, 21-43 points on blades

Retouch is seen mainly on one side of the blade in most of the specimens, and rarely on both sides (Fig. 3: 9-14). On 33 examples the retouch side has a notch. The notch is also further retouched (Fig: 3: 15-20).

Simple Blades

Out of 3157 artefacts 369 are simple blades. These are fresh with sharp edges without retouch, but with occasional battering or use marks (Fig. 3: 1-8). Most of these blades are very thin and slender, and they have a single mid-ridge. A double mid-ridge is seen only on a few examples.

Points

Points are made both on blades and flakes with 449 on the former and 301 on the latter. In both categories the tip portion of the specimens is the intersection of two tapering lateral sides of the blade/flake, either produced at the primary production of a blade/flake or by removing a small chip at one side of the blade/flake from the tip (Fig. 3: 21-43 and Fig. 3: 10-13). On a few examples secondary working is noticed at the lower end of the tool also. Mostly it is to remove some chips, possibly to prepare a tang. In both the categories points are of the simple type. However, there is an attempt to make tangs.

Broken Blades

The production of thin and slender blades has resulted in the breakage of blades either at the tip or the base with a prominent mid-ridge. These are categorised as broken blades and constitute 11.28 per cent of the collection.

Irregular Blades

Blades with one of the sides straight either with or without a mid-ridge are categorised as irregular blades. Such blades are 214 in number and constitute 6.78 per cent of the total collection. Since one of the edges of the such blades is sharp, at times with use marks such blades considered as tool types.

Borers

A beak-like projection from a blade or a flake is the main criterion to classify the specimens as borers. The awl or borer point is obtained by removing alternate chips at one point of the blade/flake. Such specimens are 201 in the collection of VGSR-C1. They account for 6.37 per cent in the total collection. Though most of the borers are made on blades, a few are made on flakes (Fig. 4: 1-4). The maximum length of borers is 46 mm and the breadth 36 mm. However, a few of these could be called micro-borers and measure about 20 mm in length and 10 mm in breadth.

Burins

A chisel edged tool caused by the intersection of two spalls at one end of a blade or an exhausted core is called a burin (Fig. 4: 5-9). There are 118 burins in VGSR-CI, and they account for 3.74 per cent of the total collection.

Scrapers

The scraper is the dominant tool type of VGSR-CI as it is represented by 502 pieces (15.90%) of the total collection (3157). The scrapers are further classified into different sub-types based on their shape, retouch and secondary working (Table 3).

Scrapers are classified as single side (125), double side (124), notched (64), convex (73), end (52) and borer-cum-end scraper (64). Most of the scrapers are single side, double side and end scrapers on blades while the notched, convex and borer-cum-end scrapers are on flakes (Fig. 4: 14-17).

Other Associated Materials

The VGSR-C1 excavation has yielded objects other than flake and blade products on stone. Such objects are pebbles, hood-stones, ground flat stones and a ringstone, as well as some bone pieces.

Pebbles

The cave floor is strewn with waterworn quartzite pebbles, which are classified into round to sub-round (79), rectan-

Table 4: Size and shape wise classification of pebbles

S.No.	Pebble Type	Big	Medium	Small	Total%	per each block (18)
1.	Round to sub-round	16	20	43	79	4.39 (5)
2.	Rectangular	23	37	27	87	4.83 (5)
3.	Flat	22	7	6	35	1.94 (2)
4.	Elongated	5	6	7	18	1 (1)
5.	Irregular	18	38	69	125	6.94 (7)
	Total	84 (7)	108 (16)	152 (33)	344 (56)	

(Numbers in parenthesis denote broken pieces)

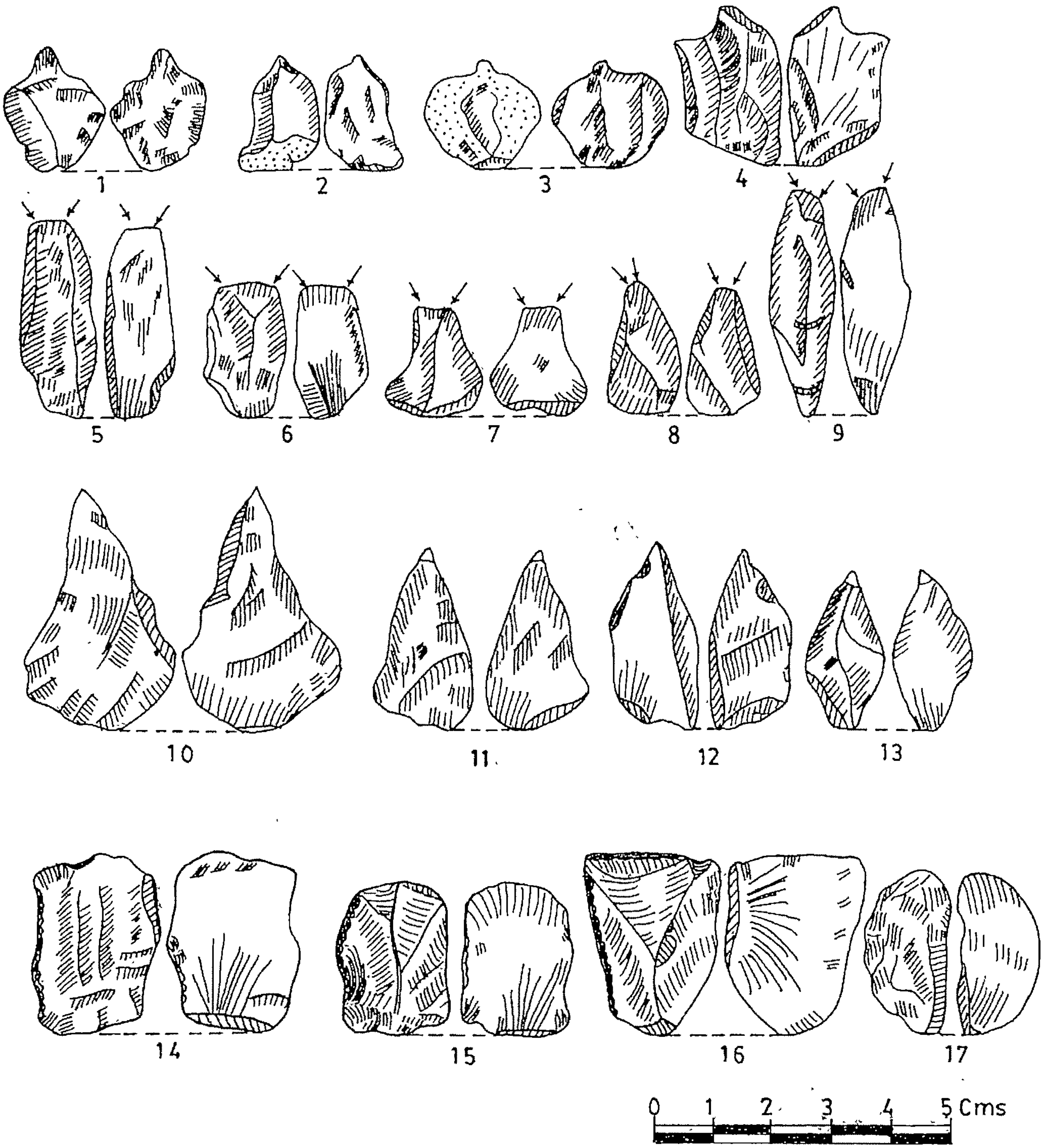


Fig. 4· Microlithic tools: 1-4 borers, 5-9 burins, 10-13 points on flakes, 14-17 scrapers

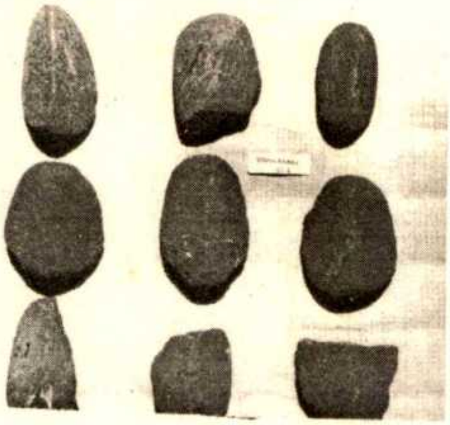


Fig. 5: Hood-stones

gular (87), flat (35), elongated (18) and irregular (125). Each of these categories is further divided into big, medium and small on their relative sizes (Table 4).

All these pebbles appear to be deliberately brought up from the nearby Peddagedda stream. The excavation was not systematic enough to bring out a pattern of their distribution. However, they are profuse towards left side (B4, C3, C4, D3 and D4) of the cave and on an average a one sq m block has 20 of these pebbles (about 5 each in the round to sub-round and rectangular category, two each of the flat pebbles, one each the elongated and about 7 pebbles in the irregular category). A systematic study of these pebbles in terms of use marks, wear patterns etc., remain to be done.

Hood-stones

Hood-stones are oval shaped pebbles with ground surfaces. The dorsal portion of the pebble is subjected to grinding, leaving the ventral portion with the original surface. The two flat portions of the same plane meet at the centre of the dorsal surface, thus projecting a mid-ridge. Since the pebbles are oval in shape, one end is broader than the other, and if they are mounted vertically, keeping the broader portion upward they look like hoods, hence they are categorised as hood-stones (Fig. 5). Such hood-stones are nine in number and they find their place 2 each in D2, C3, D3 and one each in F2, E3 and D4 blocks of VGSR-C1.

Ground Flat Stones (Saddle querns)

A flat stone with ground surface was recovered from B4, and is made on a Khondalite rock measuring 26.0 cm in length and 15.5 cm in breadth. During the removal it broke into one big and two small pieces. Similar broken pieces (3) were recovered from E2 and E3 blocks (Fig. 6).

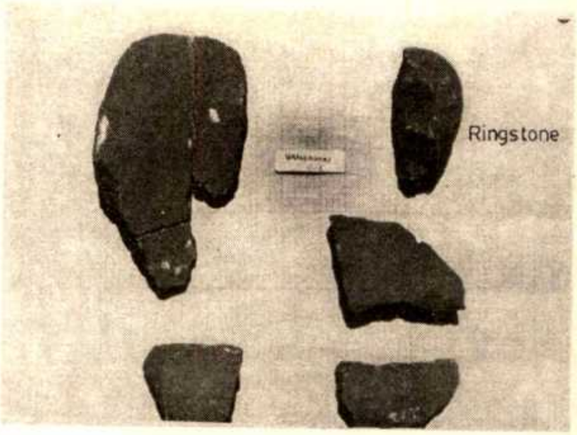


Fig. 6: Ground flat stones and ringstone

Ringstone (Mace-head)

A one third portion of a ringstone made on Khondalite was recovered from B4. An attempt to make a perforation at the centre is seen on both the sides (Fig. 6).

Bone Material

Several bone pieces including teeth and nails have been unearthed from VGSR-C1. Most of these are small pieces came from C3, D2, E2 and E3, while G2 and H2 have also contributed to some extent. The detailed study of these pieces is yet to be attempted, however, preliminary observations indicate that the bones belong to small fauna such as rodents, cats, birds and tortoise. Some of the bone pieces are ground and polished (Fig. 7).

Raw Material

Fine grained materials like chert and quartz including crystal quartz, as well as coarse grained quartzite and khondalite rocks were exploited for the VGSR-C1 Mesolithic industry. Out of 3157 mirolithic tools recovered from VGSR-C1, 1922 specimens were made on chert (60.88%) while the remaining 1235 were on quartz (39.12%). Chert therefore was preferred to quartz. The blade element was mainly on chert while the flake element was on quartz. The secondary working processes like blunting and retouch are more prominent on chert specimens than on quartz, but some crystal quartz examples are beautifully worked.

Khondalite was used for the manufacture of saddle querns and ringstones. The hood- stones are made on quartzite pebbles.

Chert and quartz are available in the form of veins in the khondalite rocks. The quartzite out-crops are seen in the vicinity of VGSR-C1 within the khondalite rocks.

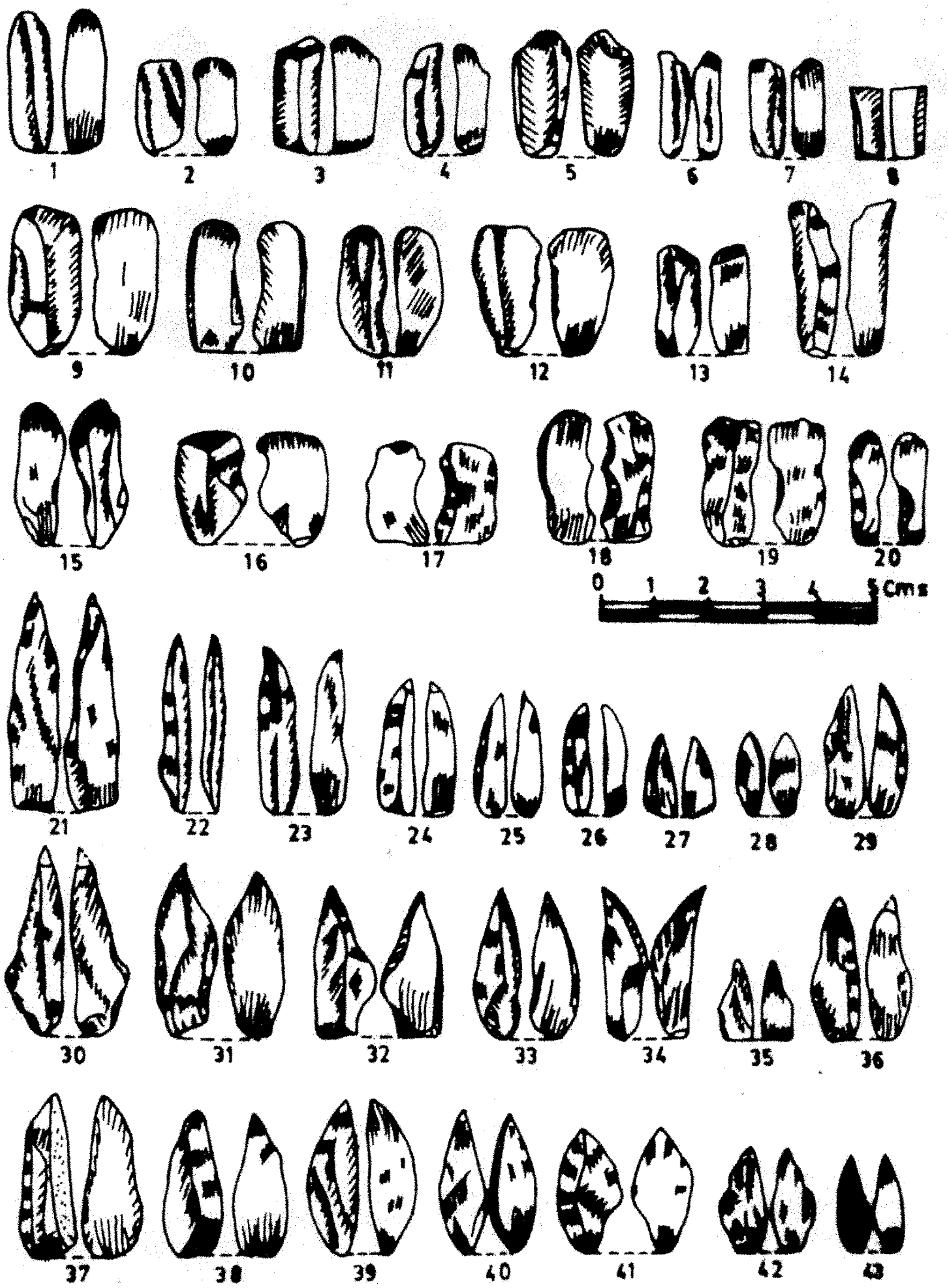


Fig. 7: Bone material: 1-17 bone pieces, 18-19 nails, 20-28 teeth, 29-33 limb bones

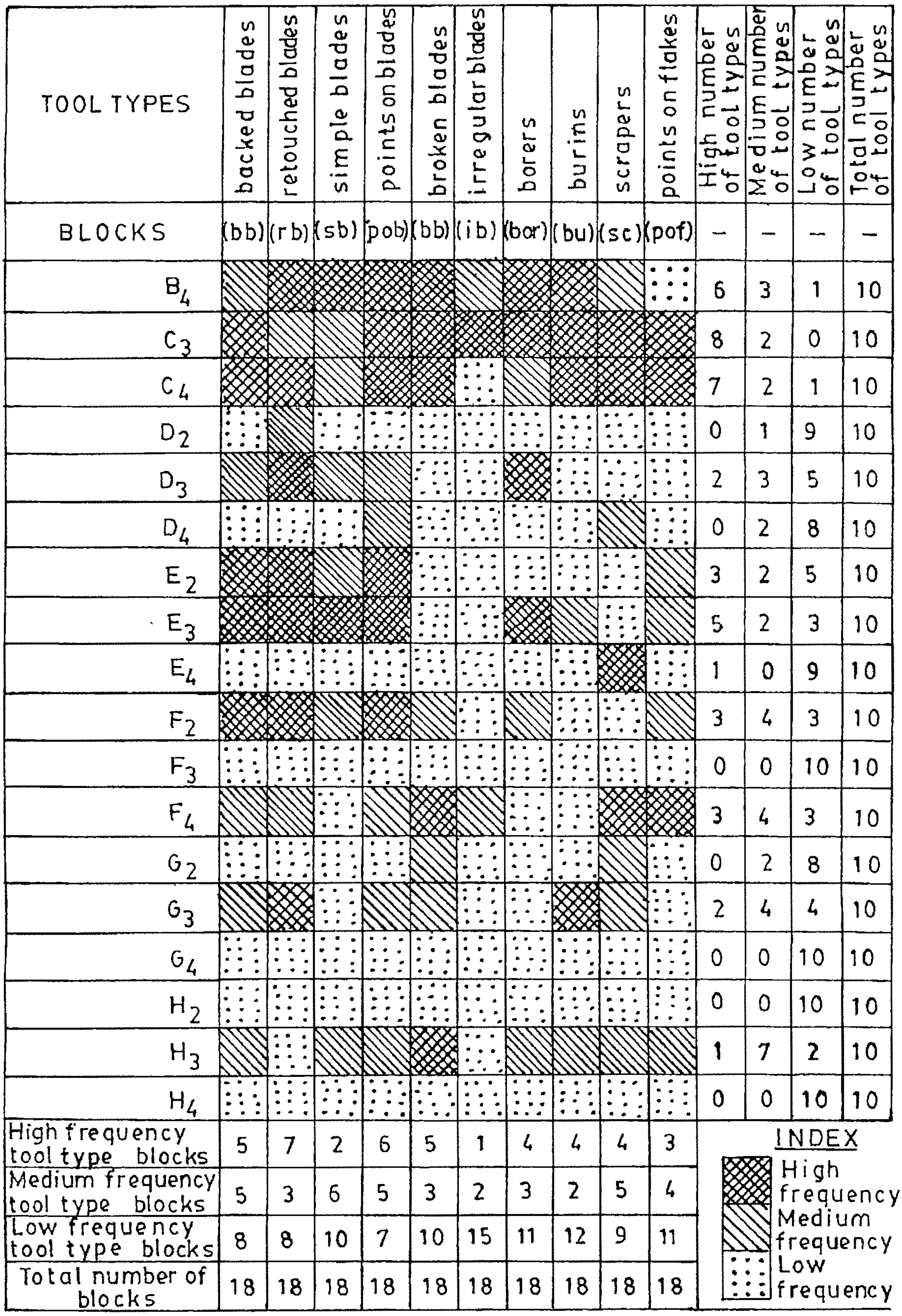
Statistical Analysis

The artefact distribution of VGSR-C1 was subjected to chi-square test to understand the association between the tool types and their spatial recovery (blocks).

H_0: There is no association between tool type and blocks.

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

where: χ^2 = chi-square value, O = observed value, E = expected value.



TOOL TYPES	backed blades	retouched blades	simple blades	points on blades	broken blades	irregular blades	borers	burins	scrapers	points on flakes	High number of tool types	Medium number of tool types	Low number of tool types	Total number of tool types
BLOCKS	(bb)	(rb)	(sb)	(pob)	(bb)	(ib)	(bor)	(bu)	(sc)	(pof)	–	–	–	–
B_4	▨	▩	▩	▩	▩	▨	▩	▩	▨	⁙	6	3	1	10
C_3	▩	▨	▨	▩	▩	▩	▩	▩	▩	▩	8	2	0	10
C_4	▩	▩	▨	▩	▩	⁙	▨	▩	▩	▩	7	2	1	10
D_2	⁙	▨	⁙	⁙	⁙	⁙	⁙	⁙	⁙	⁙	0	1	9	10
D_3	▨	▩	▨	▨	⁙	⁙	▩	⁙	⁙	⁙	2	3	5	10
D_4	⁙	⁙	⁙	▨	⁙	⁙	⁙	⁙	▨	⁙	0	2	8	10
E_2	▩	▩	▨	▩	⁙	⁙	⁙	⁙	⁙	▨	3	2	5	10
E_3	▩	▩	▩	▩	⁙	⁙	▩	▨	⁙	▨	5	2	3	10
E_4	⁙	⁙	⁙	⁙	⁙	⁙	⁙	⁙	▩	⁙	1	0	9	10
F_2	▩	▩	▨	▩	▨	⁙	▨	⁙	⁙	▨	3	4	3	10
F_3	⁙	⁙	⁙	⁙	⁙	⁙	⁙	⁙	⁙	⁙	0	0	10	10
F_4	▨	▨	⁙	▨	▩	▨	⁙	⁙	▩	▩	3	4	3	10
G_2	⁙	⁙	⁙	⁙	▨	⁙	⁙	⁙	▨	⁙	0	2	8	10
G_3	▨	▩	⁙	▨	▨	⁙	⁙	▩	▨	⁙	2	4	4	10
G_4	⁙	⁙	⁙	⁙	⁙	⁙	⁙	⁙	⁙	⁙	0	0	10	10
H_2	⁙	⁙	⁙	⁙	⁙	⁙	⁙	⁙	⁙	⁙	0	0	10	10
H_3	▨	⁙	▨	▨	▩	⁙	▨	▨	▨	▨	1	7	2	10
H_4	⁙	⁙	⁙	⁙	⁙	⁙	⁙	⁙	⁙	⁙	0	0	10	10
High frequency tool type blocks	5	7	2	6	5	1	4	4	4	3				
Medium frequency tool type blocks	5	3	6	5	3	2	3	2	5	4				
Low frequency tool type blocks	8	8	10	7	10	15	11	12	9	11				
Total number of blocks	18	18	18	18	18	18	18	18	18	18				

INDEX

▩ High frequency

▨ Medium frequency

⁙ Low frequency

Fig. 8: Block-wise distribution of high, medium and low frequency tool types

The calculated chi-square value of VGSR-CI from Table 1 thus is 533.19. The calculated value of chi-square is greater than the table value, therefore H_0 is rejected. Hence, there is a significant association between the tool types and their spatial recovery. However, the excavation was not systematic enough to understand the pattern of artefact occurrence.

In order to understand the nature of tool concentration in the cave, cluster analysis based on tool type frequency distribution was carried out for each of the 10 tool types, as every tool type has its own specific purpose and function. The high, medium and low frequencies are calculated for each of the tool types and then graphically presented against their blocks of recovery (Fig. 8).

The maximum number of high frequency tool types are present in blocks C3 (8), C4 (7), B4 (6), E3 (5); medium frequency tool types in H3 (7), F2 (4), F4 (4), G3 (4); low frequency tool types in G4 (10), H2 (10), H4 (10), D2 (9), D4 (8) and G2 (8). Among the 18 blocks, high frequencies are found in 11 blocks, medium in 12 blocks and low in 15 blocks. Since there is a heterogeneous nature of tool frequencies in each of the blocks, a further analysis was made to understand the preferences of specific tool types.

The blocks having high frequency tool types are listed with a premise that the high frequency tool types in a block had a correlation of selective preference of a particular tool type.

High frequency blocks = 11
C3 - bb + pob + brb + ib + bor + sc + pof = (8)
C4 - bb + rb + pob + brb + bu + sc + pof = (7)
B4 - rb + sb + pob + brb + bor + bu = (6)
E3 - bb + rb + sb + pob + bor = (5)
E2 - bb + rb + pob = (3)
F2 - bb + rb + pob = (3)
F4 - brb + sc + pof = (3)
D3 - rb + bor = (2)
G3 - rb + bu = (2)
E4 - sc = (1)
H2 - brb = (1)

It is clear that blocks C3, C4 and B4 had a high number of high frequency tool types, but E3, E2 and F2 had selective tool types under high frequency, such as backed blades, retouched blades and points on blades with the exception of simple blades and borers in E3. The tool types found in the first six blocks seem to be high technology tool types as the blade production, blunting and retouch are considered more efficient modes of stone tool technology. The remaining blocks (F4, D3, G3, E4 and H2) are represented by tool types with a flake element. The observations of this analysis are plotted in the schematic sketch of the cave floor area, in order to understand the spatial location of the observed facts

The high frequency tool type analysis and its graphic representation has shown that the cave had two tool concentration units, one almost at the centre of the cave and the other at left side of the outer corner. Moreover, these two units are high efficiency tool concentration units.

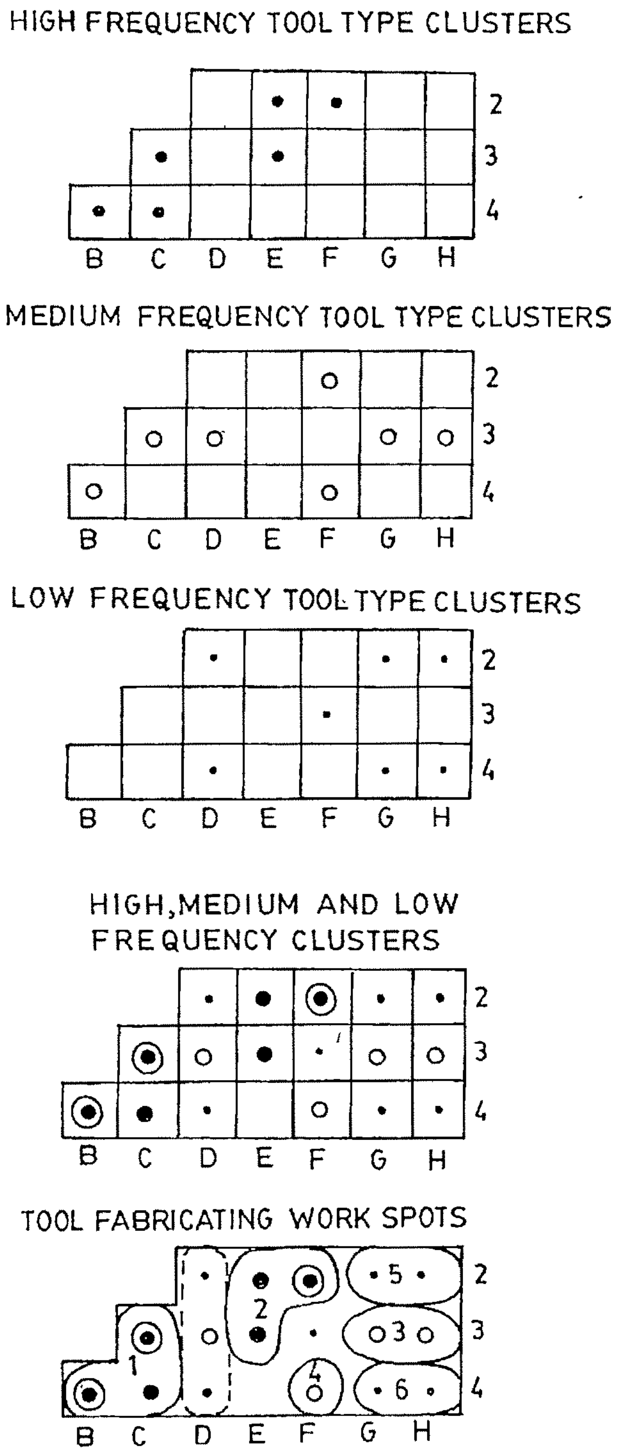
A similar analysis has been extended to the medium frequency tool types, listed below, to understand medium range selective preferences, if any.

Medium frequency blocks = 12
H3 = bb + sb + pob + bor + bu + sc + pof = (7)
F2 = sb + brb + bor + pof = (4)
F4 = bb + rb + pob + ib = (4)
G3 = bb + pob + brb + sc = (4)
B4 = bb + ib + sc = (3)
D3 = bb + sb + pob = (3)
C3 = bb + sb = (2)
C4 = sb + bor = (2)
D4 = pob + sc = (2)
E2 = sb + pof = (2)
E3 = bu + pof = (2)
G2 = brb + sc = (2)

Out of the 18 excavated blocks the medium frequency tool types are distributed in 12 blocks. More or less all are evenly distributed with the exception of block H3, which is represented by a high number of tool types (7). Among these 12 blocks, F4, G3, B4, D3 and C3 blocks have high efficiency tool types, while H3 and F2 have a combination of high and low efficiency tool types, and the remaining D4, E2, E3 and G2 blocks are represented by tool types with a flake element. The observed facts of this analysis are schematically presented in Figure 9.

Figure 8 shows that the medium frequency tool types are clustered into different units. However, blocks B4, C3 and F2 are already in the high frequency blocks and the present analysis further suggests that these three blocks also have a high concentration of tool types. D3 is a buffer block between the two tool concentration units of high frequency tool types and if at all there is an error of overlap, it takes care of the same. The remaining blocks are clustered into two units, F4 as one unit at the periphery of the cave and G3 and H3 as another unit in the right hand corner of the cave.

The low frequency tool types are distributed in 15 blocks. The high number of tool types ranging between 8 and 10 are found in 7 blocks. Less than 50% are distributed within the remaining blocks. The six blocks with a high number of tool types are:


HIGH FREQUENCY TOOL TYPE CLUSTERS

MEDIUM FREQUENCY TOOL TYPE CLUSTERS

LOW FREQUENCY TOOL TYPE CLUSTERS

HIGH, MEDIUM AND LOW FREQUENCY CLUSTERS

TOOL FABRICATING WORK SPOTS

Fig 9:High, medium and low frequency clusters of tools

F3 = bb + rb + sb + pob + brb + ib + bor + bu + sc + pof = (10)
G4 = bb + rb + sb+ pob + brb + ib + bor + bu + sc + pof = (10)
H2 = bb + rb + sb + pob + brb + ib + bor + bu + sc + pof = (10)
H4 = bb + rb + sb + pob + brb + ib + bor + bu + sc + pof = (10)
D2 = bb + sb + pob + brb + ib + bor + bu + sc + pof = (9)
D4 = bb + rb + sb + brb + ib + bor + bu + pof = (8)
G2 = bb + rb + sb + pob + ib + bor + bu + pof = (8)

All tool types are represented in blocks F3, G4, H2 and H4. The blocks with low frequency tool types are again plotted on the schematic representation of the cave floor area. The low frequency tool types are distributed into two clusters on the right side of the cave, one in the interior (G2 and H2 blocks) and the other at the periphery (G4 and H4 blocks). The remaining blocks — D2 and D4 — like D3 in the medium frequency distribution analysis, act as a buffer between the two high frequency and efficient tool concentration units. While F3 falls between the high and medium frequency concentrations.

The statistical analysis based on tool type frequencies and their distribution against their spatial recovery has indicated six tool concentrations on the 18 sq m floor area of VSGR-C1. The tool concentrations here, may be considered as tool fabricating work spots, with a limitation of non-inclusion of cores, flakes and chips. Out of these six work spots, two each of high, medium and low efficiency are discernible (Fig. 9). The central and the left side of the cave comprise the main workshop for the production of high efficiency tool types while the right side was meant for other tool types.

Discussion

Prehistoric evidence from Visakhapatnam District in the Eastern Ghats is so far very limited. Though the coastal belt has yielded a very good number of Mesolithic sites, besides sites of other prehistoric cultural phases, such as Lower, Middle and Upper Palaeolithic, Neolithic and Megalithic (Reddy 1978; Prakash 1981, 1981a, 1986, 1986-87 and 1988; Naseem 1981; Prakash *et al.* 1994; Reddy *et al.* 1995; Rath *et al.* 1997), the Ghats are represented only by the Mesolithic culture (Murthy 1986; Prakash 1986-87). However, a solitary cave site at the periphery of Ghats has yielded flake tools (Prakash *et al.* 1995), while Murthy (1986) classified some of the blades of the Araku valley of the Eastern Ghats as Upper Palaeolithic solely based on their morphometric characters. The Mesolithic sites so far identified in this part of the Eastern Ghats are about 20 in number, and they are located either on the flat low-lying hill tops or in the rock-shelters. Important among them are Bodeput (hill top site), Bdeguda (rock-shelter site) in the Araku valley, Tajangi (hill top site), Kinerla (rock-shelter site) in Tajangi valley, and Babusala (a cliff site) and Sariyapalli (hill top site) in

Rodakota area. The material culture from these sites is only of stone tools and they are very few in number, when compared to the VGSR-C1 site.

The presence of 3157 finished tools besides a few thousand biproducts (cores, flakes and chips) from an 18 sq m area from a small cave (the entire cave floor area measures about 38 sq m) makes the site one of the richest known Mesolithic sites. The blunted back element on micro blades, the geometric forms particularly triangles coupled with lunates makes the industry a geometric microlithic industry. The occurrence of saddle querns, a ring-stone and hood-stones further attests to the fact that the Mesolithic industry of VGSR-C1 belongs to the late Mesolithic culture.

The production of small blades and subsequent blunting and retouch seem to be a technological refinement. The size of the blunted blades is too small to be used individually and obviously a part formed of compound tool. Application of such a technological advancement is not seen either on points or scrapers. Though the points, both on blades and flakes, account for 23.76%, they are simple without any prominent tang. However, the notched blades (33), borers (201) and burins (118) seem to be produced with meticulous care, as the retouch on both notch or groove, the tiny awl point and the thin chisel edge on burins are very perfect. Perhaps, these three tool types acted as intermediary tools for the utilization of backed blades, probably for wood working.

The hood-stones of VGSR-C1 look like mullers. If a muller is used for food processing on a quern they attain either flat or smooth convex surfaces on both the sides. But the hood-stones had the ground and polished surface with a mid-ridge only on one surface. The ethnographic observation by the author among the tribes of the Eastern Ghats finds no parallel to the hood-stones. The mullers used by the tribals are entirely different as at no place on the functional side had a mid-ridge formed. Till we find an ethnographic parallel the hood-stones remain objects of non-economic utility, perhaps objects of a ritual nature, since they resemble the hood of a snake, if they are mounted vertically with the broad end up.

Statistical analysis has shown that the 18 sq.m cave floor area had 6 spots of tool concentrations, two each of high, medium and low concentrations. It is also inferred that the central and left hand side of the cave had high efficiency tool concentrations as distinct from the right side and peripheral portions of the cave.

Acknowledgements

I would like to express my sincere thanks to Mr. K. Gopikrishna, Project Fellow, Department of Anthropology, Andhra University, Visakhapatnam for his help during the VGSR-C1 excavation and analysis of artefacts. I would also like to thank Mr. P. Stephen, Research Scholar, Department of Anthropology, who helped me in the preparation of the drawings.

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A Preliminary Analysis of Microblades, Blade Cores and Lunates From Watgal: A Southern Neolithic Site

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Abstract

Microblades, blade cores, and lunates from Watgal, a stratified Southern Neolithic site in Raichur District (Karnataka), were studied in an attempt to identify temporally-linked differences. Techniques of manufacturing these artefacts at Watgal remained relatively consistent for more than a millennium. Quantitative methods were used to identify subtle changes through time in microblades and lunates. With some exceptions, these changes seem to indicate a trend towards standardization within the site's chipped-stone assemblage.

Introduction

In traditional societies, the persistence of certain artefact types through long intervals may pose problems in attempting to identify temporally-linked changes in material culture. The Watgal site was occupied periodically over thousands of years, and continuously or near-continuously during the Southern Neolithic (as defined by the Allchins 1982 and 1997), from at least 2700 B.C. to 1000 B.C. or later. Changes through time in some artefact categories, such as pottery, are apparent, and have been used elsewhere to differentiate one previous occupation and four subdivisions within the Southern Neolithic at Watgal (Deavaraj *et al.* 1995). Throughout much of the span of site use, however, the methods and materials used for the manufacture of chipped-stone tools do not appear to change. The presence or absence of microblades or microliths alone is not sufficient to differentiate one occupation from another in the Watgal chipped-stone assemblage. Therefore, to determine if there are characteristics which distinguish certain chipped-stone artefact categories within each occupation, it is necessary to use a quantitative approach; and, moreover, to base this approach on a sample reflecting a systematic maximum recovery of artefacts. This study examines three types of artefacts: the Watgal microblades, the blade cores from which they were made, and the most common microlithic tool made from these microblades, lunates, in an attempt to identify any distinguishing patterns in their physical characteristics or temporal distributions.

The Site Investigation

The Watgal site, adjacent to the modern village of the same name, is located in Raichur District, Karnataka, India (Deavaraj *et al.* 1995: 58, Fig. 1). Recent work at the site, a cooperative project of the Department of Archaeology and Museums, State of Karnataka, with Dr. J.G. Shaffer, has spanned five field seasons: 1988-89, 1990-91, 1991-92, 1993-94, and 1997-98. By the end of the fifth season, twenty-two 5 x 5 m excavation units, one 2.5 x 5 m excavation unit, and a megalith had been excavated to sterile subsoil or to immovable stone. All soils were dry-screened through 1/4 inch wire mesh, and all specimens were collected. Artefacts, including chipped-stone microblades, tools, fragments and debris, and other cultural materials were abundant throughout each excavation unit.*

These field investigations have established that most archaeological deposits at the site reflect the Southern Neolithic complex. The five occupations identified at Watgal have been termed, from lowest to highest: Occupation I, Occupation IIA, Occupation IIB, Occupation III, and Occupation IV (Deavaraj *et al.* 1995). The four later occupations, Occupations IIA through IV, are considered to be continuous and have been attributed to the Southern

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* All artefact data and inventories are currently available from J.G Shaffer, Department of Anthropology, Case Western Reserve University, Cleveland, Ohio, 44106, U.S A., pending final publication.

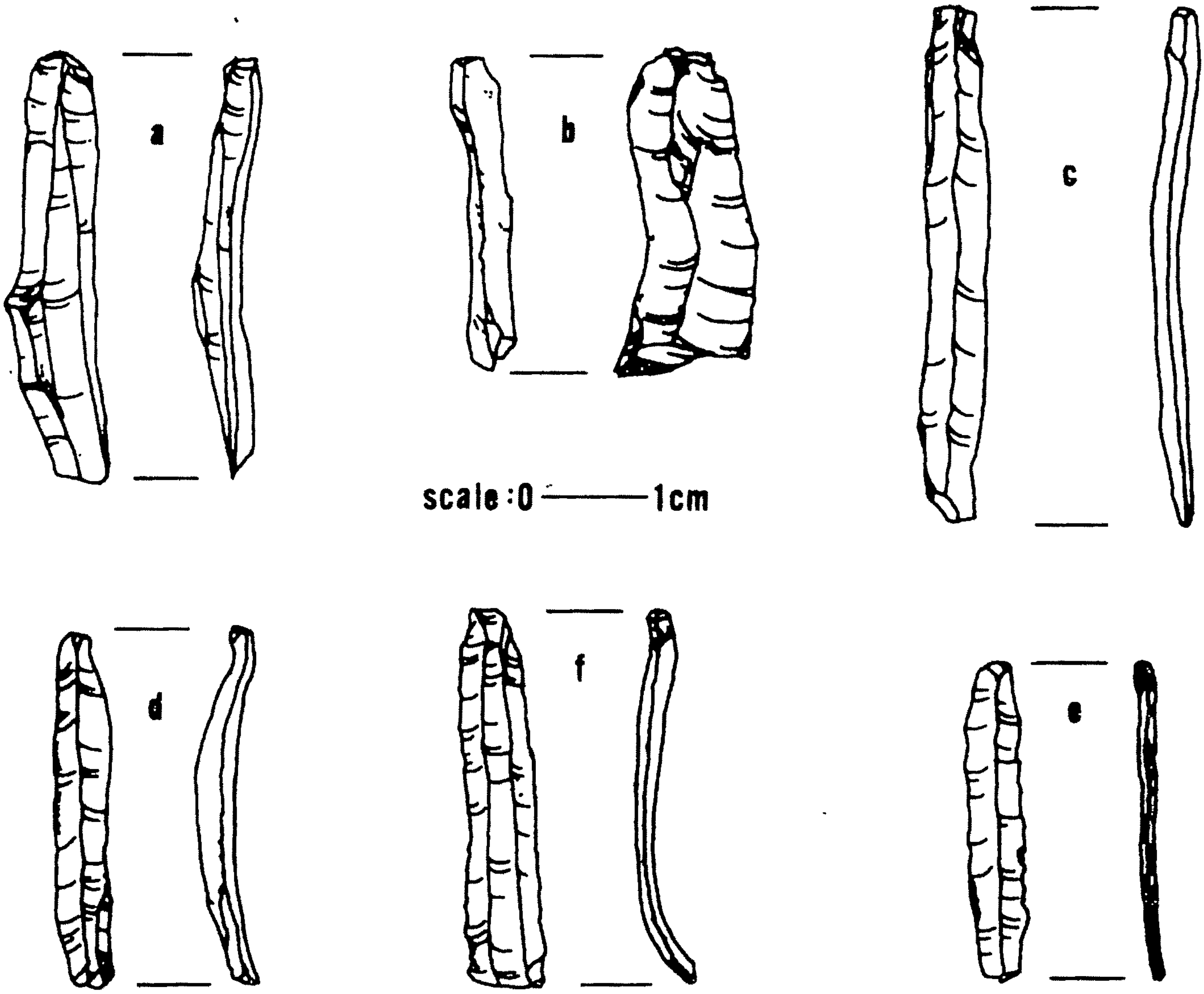

Fig. 1: Blades, Occupation I (a-b); Occupation III (c-e); Occupation IV (f)

Neolithic; while the earlier and aceramic Occupation I, underlying the others, is judged to be problematic and most probably discontinuous from the rest. The occupations correspond roughly with changes in the soil stratigraphy of the excavation units, and distinctions between occupations have been made both by stratigraphic differences and by the occurrence and distribution of pottery and various other artefact types (Deavaraj *et al.* 1995). The analysis presented here is based on the chipped stone recovered from ten of these excavation units: A1 through A6, B1, B6, C5, and E3. Comparatively few chipped-stone specimens were found within pits, postholes, and other feature contexts in these units, only 405 objects overall. These will be discussed in the final site report, but are not included in this analysis for contextual reasons. However, from the general fill of these ten units alone, the chipped-stone tools, microblades, cores, flakes, fragments, and debris total 12,539 specimens.

Chipped-stone microblades and microliths, with cores and the debris from their manufacture, are present in all occupations at the site. Evidently during most of the span of site habitation, the prehistoric inhabitants of Watgal relied on the manufacture of blades in large quantities to supply their chipped-stone tools. A preliminary inspection of the chipped-stone from Watgal, together with a review of the relevant literature, suggested that neither the sources of certain raw materials nor methods of tool manufacture changed through long periods of time at Watgal. Therefore, another, quantitative, approach was required to compare the assemblages of each occupation at the site for any distinctive patterning associated with their temporal

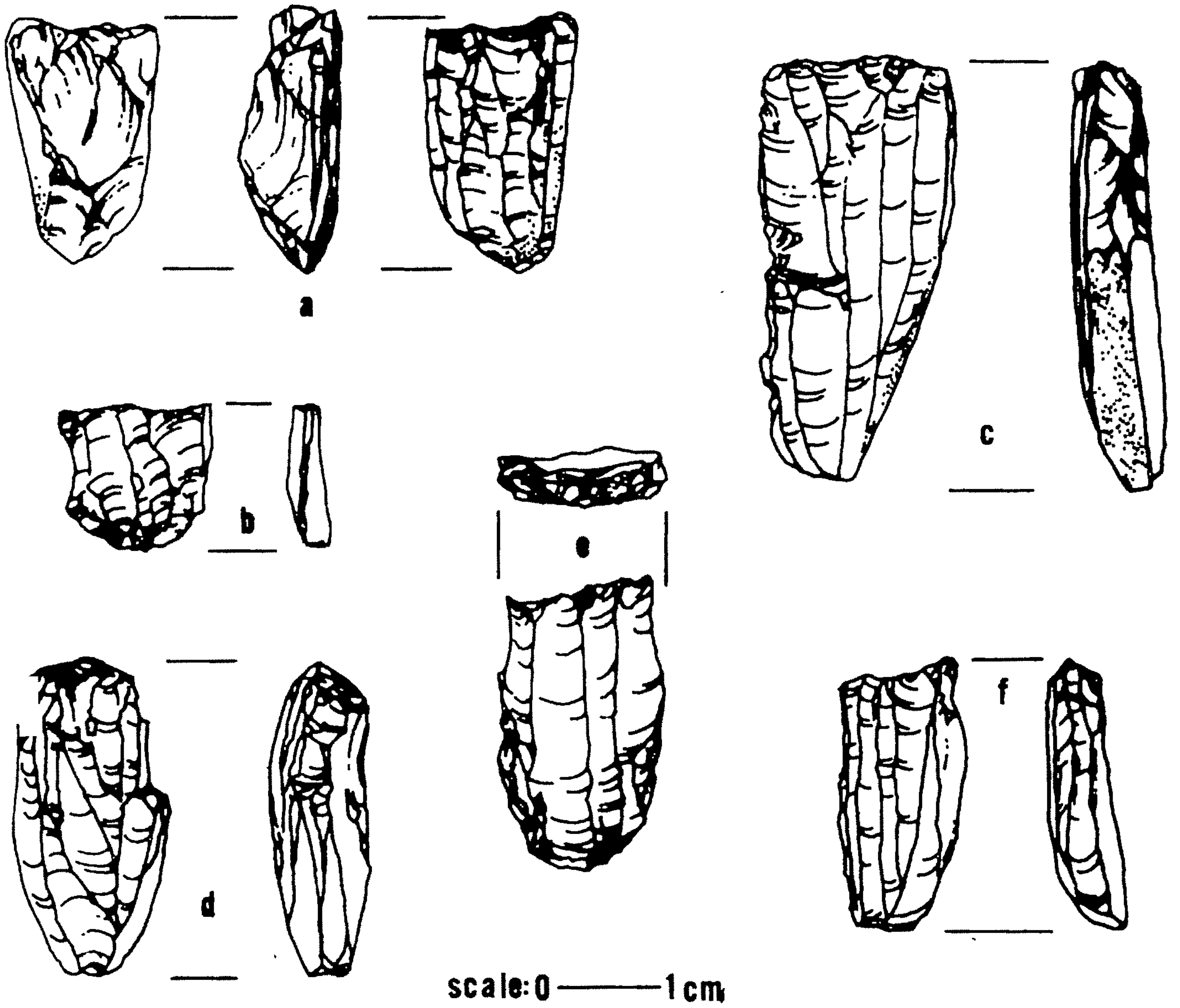

Fig. 2: Blade cores, Occupation I (a-b); Occupation IIB (c), Occupation III (d-e); Occupation IV (f)

distribution. Three artefact categories, blades, blade cores, and lunates, were selected for this study.

Artefact Descriptions

The blades of Watgal belong to the category of chipped-stone tools variously termed unifacial blades, parallel-sided flakes, prismatic blades, lamellar blades, and/or flake knives (Fig. 1)**. Small blades are commonly called bladelets or microblades, though no definition in general use quantifies the distinction between blade and bladelet (Khanna 1989: 12). These tools are specialized flakes of a predetermined form which have been detached in a single motion from a prepared core, generally by pressure or by indirect percussion (Pelegrin 1988 and 1994; also Inizan and Lechevallier 1995). Systematic removal of blades from a core produces the distinctive "fluted" surface most characteristic of blade cores. Watgal blade cores are not cylindrical or indeed regular (Fig. 2). Identified by one or more fluted blade removal faces extending over parts of the core surface, Watgal cores can be pyramidal, wedge, irregular conical, or even tabular in shape.

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2 Additional illustrations of artefact types from each occupation may be found in Shaffer, J.G 1992. *Archaeological Research at Watgal, Raichur District, Karnataka: A Report on the 1991-1992 Activities* (The unpublished reports for each field season have been submitted to and are on file with the Department of Archaeology and Museums, Karnataka State Government, Mysore)

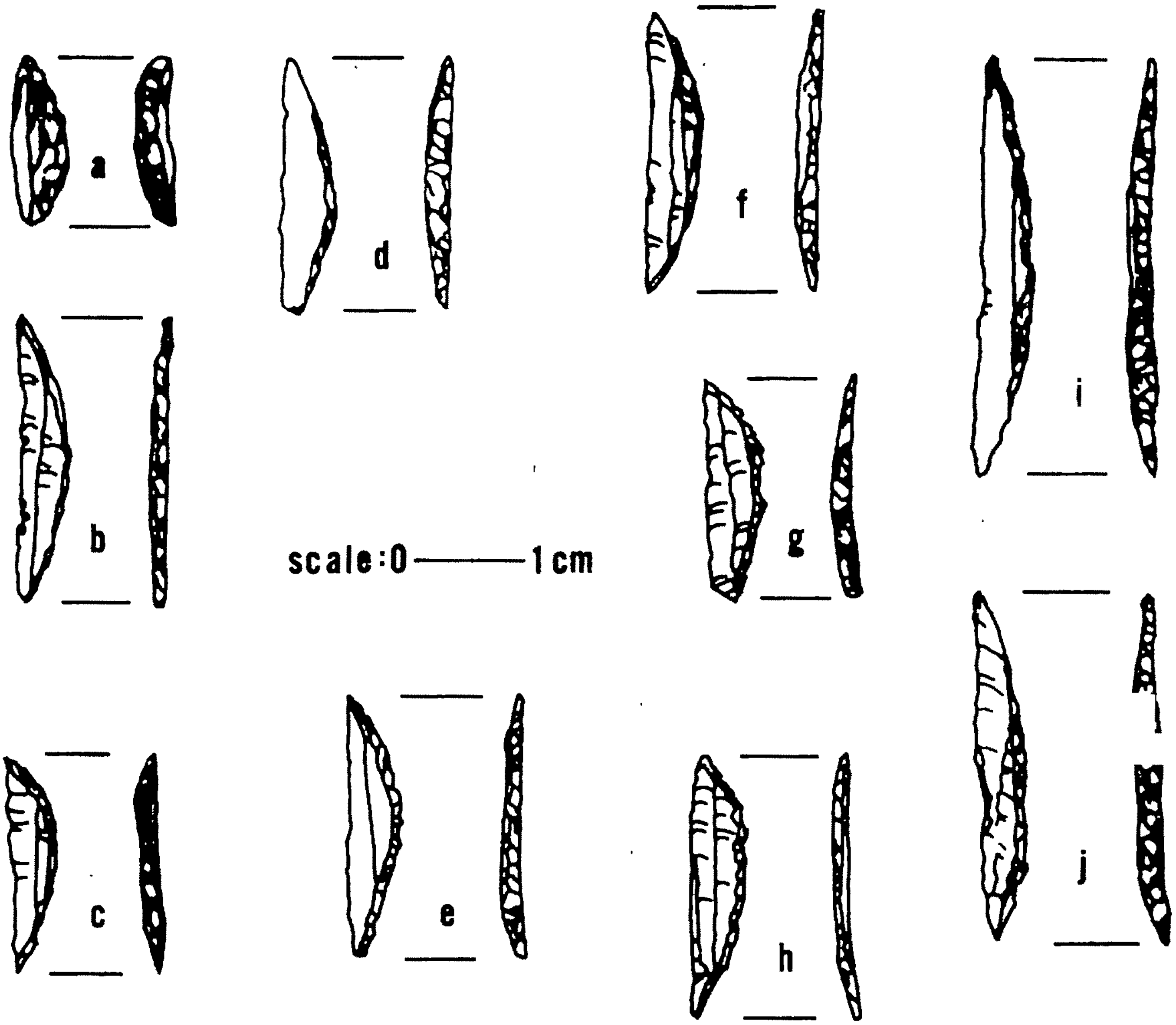

Fig. 3: Lunates, Occupation I (a-b); Occupation IIA (c-d), Occupation IIB (e-g); Occupation III (h-i); Occupation IV (j)

In general, blades can be used as tools without further modification, or can be retouched to produce various formal/functional tool types. Several retouched blade forms are present at Watgal in greater or lesser numbers. One such retouched blade tool, the lunate, is relatively common (Fig. 3). A lunate is made from a blade fragment which has been retouched along the entire length of one margin, blunting that margin and reshaping it to a curve, which, by intersecting with the opposite unretouched margin, forms a point at each end of the tool. Microscopic analysis of lunates from Laharia-dih rock-shelter site, Uttar Pradesh, found bright polish, associated with cutting soft plant material, on two of the four specimens exhibiting use-wear, while the remainder exhibited duller polishes attributed to meat/hide cutting and to possible projectile/piercing action, respectively (Chaturvedi 1991-92: 9). Following a similar examination, lunates from Mehrgarh were concluded to have been used as sickle elements for cutting soft plant material (Vaughan 1995: 619). To date, no microscopic analysis of the Watgal lunates has been done, and their specific purpose (or purposes) at this site remains to be identified.

Among the factors determining the size of blades and blade tools is the maximum possible length of the blade cores, which is in turn regulated by the maximum size of available pieces of unworked stone. As at other sites in south India, suitable material for the manufacture of chipped stone tools may not have been readily available at Watgal. The stone used in the Watgal chipped stone industries may only have been found as small nodules in river gravels (Allchin and Allchin 1982: 86), or may have been quarried elsewhere, like the chert used at Budihal, which Paddayya has traced to veins within the limestone deposits nearby (Paddayya 1993: 581). Whatever the source, the dimensions of Watgal blade cores from all occupations combined are quite small, averaging only 2.6 cm in length, less than 1.6 cm in width, and 1.0 cm in thickness, although they may have been discarded only when "exhausted," (i.e., too small for further use). Similarly, the unbroken blades from all occupations at Watgal average only about 2.5 cm in length and less than 0.75 cm in width. The lengths of over 99 % of the unbroken blades measured to date fall within the range of 1.0 cm to 5.6 cm. While these intact blades may have been somewhat shorter than the rest initially, and therefore perhaps less susceptible to breakage, the widths of broken blade fragments appear to be comparable to those of the surviving whole blades. Hence, blades from Watgal can be considered true microblades or bladelets, although they will primarily be referred to as "blades" in this analysis. Retouched tools made from the Watgal microblades are correspondingly small. More detailed discussion of the measurements of these blades, blade cores and lunates is presented below.

Materials Used in the Manufacture of Chipped Stone Tools at Watgal

As mentioned above, chipped-stone specimens, including tools, blades, cores, flakes, fragments and debris, are abundant in every occupation in every excavation unit at Watgal. Chert is the most common material by far, almost three quarters (74%) of the 12,539 specimens in this analysis. While a variety of cherts were used at Watgal, most chert specimens (93%) are of a *single* type of chert: a fine-textured material, grading into jasper, distinguished by a red-brown to yellow-brown colour. On the Munsell scale this ranges from the extremes of 10 R 3/3 "dusky red," to 10 YR 5/4 "yellowish brown". This chert will be referred to here as type 1 chert (abbreviated to "Ch1 Chert"). The specific source of this material, which does not occur naturally at the site, has not yet been identified by the authors, if different from the river gravels or limestone deposits mentioned above. Ch1 Chert is clearly the material of choice for blade manufacture at Watgal: of all the blades and blade fragments studied from the site, fully 79% are of this same chert.

For this analysis, the various cherts not identifiable as Ch1 Chert have been grouped together and termed "Other Cherts". This category lumps together 10 or more different cherts which can be distinguished from Ch1 Chert and from each other by their colours, textures, and degrees of translucence. These Other Cherts constitute less than 5% of the chipped-stone in this study, and only 7% of the total chert. Blades and blade fragments of any cherts other than Ch1 Chert are not common; and summed together constitute only 1% of all blades and blade fragments.

Chalcedony is the second most common material used in the chipped-stone industry of Watgal, comprising almost one fifth (19%) of the chipped-stone in this analysis. Flakes and cores with patches of cortex in the Watgal assemblage clearly indicate that the source material is small, rounded nodules or pebbles. Chalcedony was apparently satisfactory for blade manufacture, since over 18% of all blades and blade fragments are of this material.

Less than one tenth (7%) of the Watgal chipped-stone studied is a "milk-white," crystalline stone variously termed quartzite or vein quartz. This material will be termed "Quartz" for the purposes of this report. Quartz blades and blade fragments are less than 1% of the blade total, demonstrating that this type of stone was not preferred for blade manufacture.

Overview: Distribution of Blades, Blade Cores, and Lunates by Occupation

As stated above, chipped-stone artefacts are abundant in all five occupations at Watgal. Since the occupational deposits vary in thickness, and hence in volume of excavated soil, raw numbers or counts of chipped-stone do not give a balanced picture of the representation of chipped-stone in each assemblage. In any attempt to characterize and compare the assemblages of the five occupations at Watgal, it is thus necessary to select a method of comparison which will compensate for these volumetric and quantitative differences. In a previous study (Deavaraj *et al.* 1995), the measure of density was used. This measure gives an indication of the likelihood of finding a certain artefact within a given volume of excavated soil. Values for the densities of chipped-stone in each occupation were calculated by dividing the number of chipped-stone specimens by the excavated volumes of soil. Since these densities already have been reported and discussed, it will only be said here that the ratio of the volumes of excavated soil is Occ. I = 1.85 : Occ. IIA = 1.25 : Occ. IIB = 1 06 : Occ. III = 1.58 : Occ. IV = 1, as calculated from the data from six excavation units, A2 through A6 and B1. Although soil volumes from more recently excavated units are not yet included in these calculations, it is not anticipated that any addition will cause major changes to this ratio. Such artefact density values will be reexamined in the presentation of the Watgal data in the final site report. The reader is advised to take this volumetric ratio into consideration when evaluating the raw numbers given here for the chipped-stone specimens in each Watgal occupation.

Table 1: Material profiles for selected chipped-stone categories: blades, blade cores, and lunates (includes damaged specimens and identifiable fragments)

CHIPPED STONE ASSEMBLAGES	Chalcedony	Chl Chert	Other Cherts	Quartz	Unid.	COMBINED
Occupation I (1079 items = 100%)						
Blades	3.24%	1.11%	3.52%	2.32%	0.19%	10.38%
Blade Cores	0.19%	0.19%	-	0.19%	-	0.57%
Lunates	0.19%	0.19%	0.09%	0.09%	-	0.56%
All Other	10.65%	2.50%	33.64%	41.52%	0.19%	88.50%
Occupation IIA (1221 items = 100%)						
Blades	6.55%	29.89%	1.15%	0.41%	-	38.00%
Blade Cores	0.57%	0.90%	0.08%	0.16%	-	1.71%
Lunates	0.49%	2.21%	-	-	-	2.70%
All Other	11.55%	27.85%	2.46%	15.72%	-	57.58%
Occupation IIB (3778 items = 100%)						
Blades	13.68%	30.94%	0.40%	-	-	45.02%
Blade Cores	0.93%	1.22%	0.05%	-	-	2.20%
Lunates	0.08%	1.09%	0.03%	-	-	1.20%
All Other	17.71%	31.84%	0.79%	1.22%	0.03%	51.59%
Occupation III (4526 items = 100%)						
Blades	5.63%	38.95%	0.27%	0.35%	0.02%	45.22%
Blade Cores	0.29%	1.68%	0.04%	-	0.02%	2.03%
Lunates	0.18%	1.72%	0.04%	-	-	1.94%
All Other	6.94%	41.34%	1.10%	1.41%	0.02%	50.81%
Occupation IV (1935 items = 100%)						
Blades	3.05%	40.41%	0.57%	0.10%	0.05%	44.18%
Blade Cores	0.36%	1.45%	-	-	-	1.81%
Lunates	0.05%	0.52%	0.05%	-	-	0.62%
All Other	5.84%	44.60%	1.09%	1.76%	0.10%	53.39%

In this study, the distributions of chipped-stone artefacts in each occupational assemblage are compared using the measure of relative frequency. This method focuses on the representation of selected types within a given assemblage. To calculate the relative frequency of each artefact type in each occupation, the number of artefacts in the type category was divided by the total number of chipped-stone specimens in that occupation. The values for the artefact types in each occupation are thus expressed as percents of the total amount of chipped-stone for that occupation. By so doing, the chipped-stone totals for the five occupations are "equalized," each being adjusted to 100%. Using these relative frequencies, it becomes easier to visualize the likelihood that specimens of a particular form or material occur within the chipped-stone assemblage of a given occupation.

Table 1 presents the relative frequencies of the three selected morphological categories (blades, blade cores, and lunates) in each of the five occupational assemblages at Watgal. Each category includes damaged specimens and identifiable fragments as well as whole specimens, and each is subdivided into the material subgroups of Chalcedony, Ch1 Chert, Other Cherts, and Quartz, with unidentified materials also listed. Figures 4, 5 and 6 illustrate the distributions of these morphological categories in a graphic format. Taken together as "material profiles," the relative frequencies of the specimens in these material and morphological subcategories assist in comparing the lithic assemblages of different occupations.

Occupation I Material Profile

Occupation I is the oldest of the series of occupations at Watgal, discontinuous from the others, and, in the absence of radiocarbon dates, inferred to date ca. 3000 B.C. or earlier (Deavaraj *et al.* 1995). The only cultural materials attributed to this occupation are chipped-stone artefacts and debris. In addition to microblades and microliths, there are also present large, heavily patinated flake artefacts of a "Middle Palaeolithic" style. These are included in the totals of all chipped-stone, but as flake tools, are not otherwise incorporated in this analysis. Chipped-stone from Occupa-

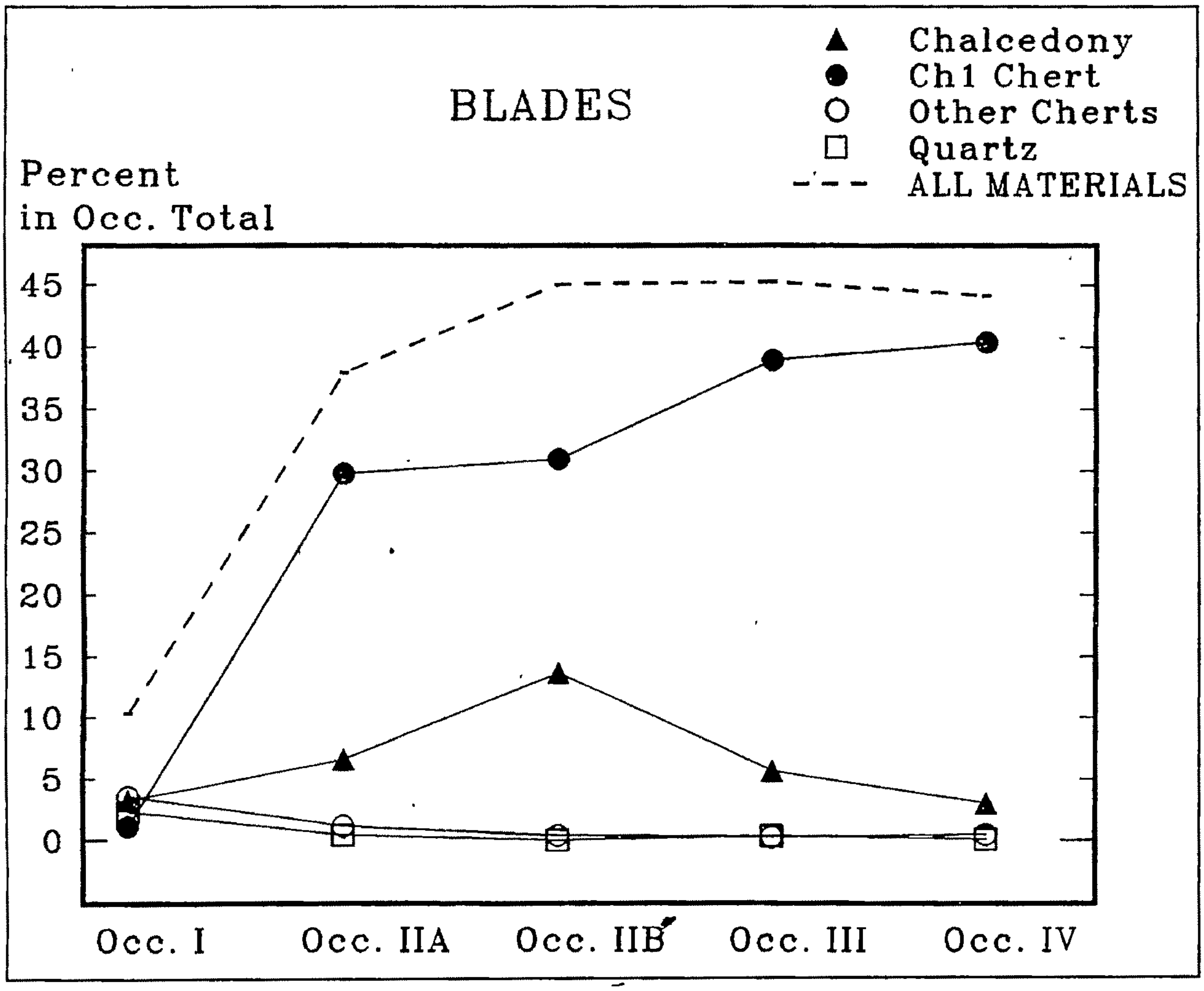

Fig. 4: Per cent of blades and blade fragments in total chipped-stone, by occupation, all material categories

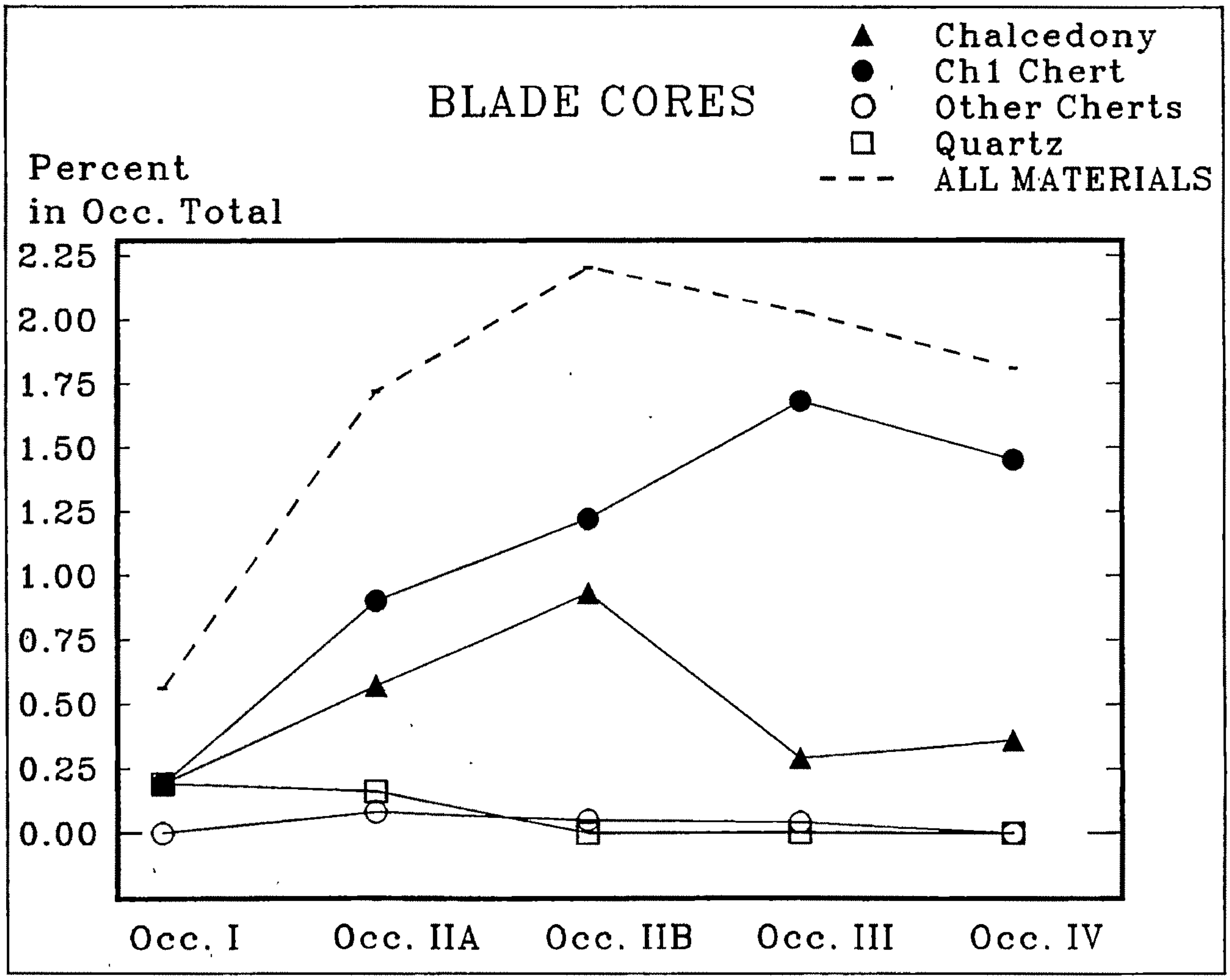

Fig. 5: Per cent of blade cores and core fragments in total chipped-stone, by occupation, all material categories

tion I comprises less than 9% of the 12,539 specimens studied here.

The chipped-stone specimens in the Occupation I assemblage are made of the cherts, chalcedony, and quartz discussed above. While examples of all material types are present in each occupation, Occupation I has the material profile *most divergent* from every other occupation at Watgal. In the Occupation I assemblage, both the selected morphological categories (blades, blade cores, and lunates) and the material subgroups in this occupation reveal pronounced quantitative differences from all subsequent occupations at the site.

Examining first the totals for all materials combined (Table 1), it can be seen that in Occupation I the relative frequencies of blades, blade cores, and lunates are not only at their minimum for any occupation, but that these minimum values are markedly lower than the values in any other occupation. In the category of blades, the subtotals for each material type indicate the use of a variety of materials, with all four material types represented in the Occupation I assemblage. For Chalcedony and of Ch1 Chert, however, the relative frequencies are at or near their minimum values for all occupations at the site; while the frequencies for Other Cherts and of Quartz, though roughly equivalent, are nonetheless at their peaks. Note also that in Occupation I Chalcedony blades exceed Ch1 Chert blades by a ratio of almost 3 to 1.

Similarly, the occurrence of blade cores of all types is at its minimum in Occupation I; in all, there are only 6 blade cores and blade core fragments. Relative frequencies for the subcategories of Chalcedony and Ch1 Chert blade cores are also minimal, but the subcategory of Quartz blade cores is at its peak. Lunates as well are present in all material categories in roughly equivalent, low, percentages.

Occupation IIA Material Profile

Occupation IIA, along with all subsequent occupations, has been assigned to the Southern Neolithic. Radiocarbon dates

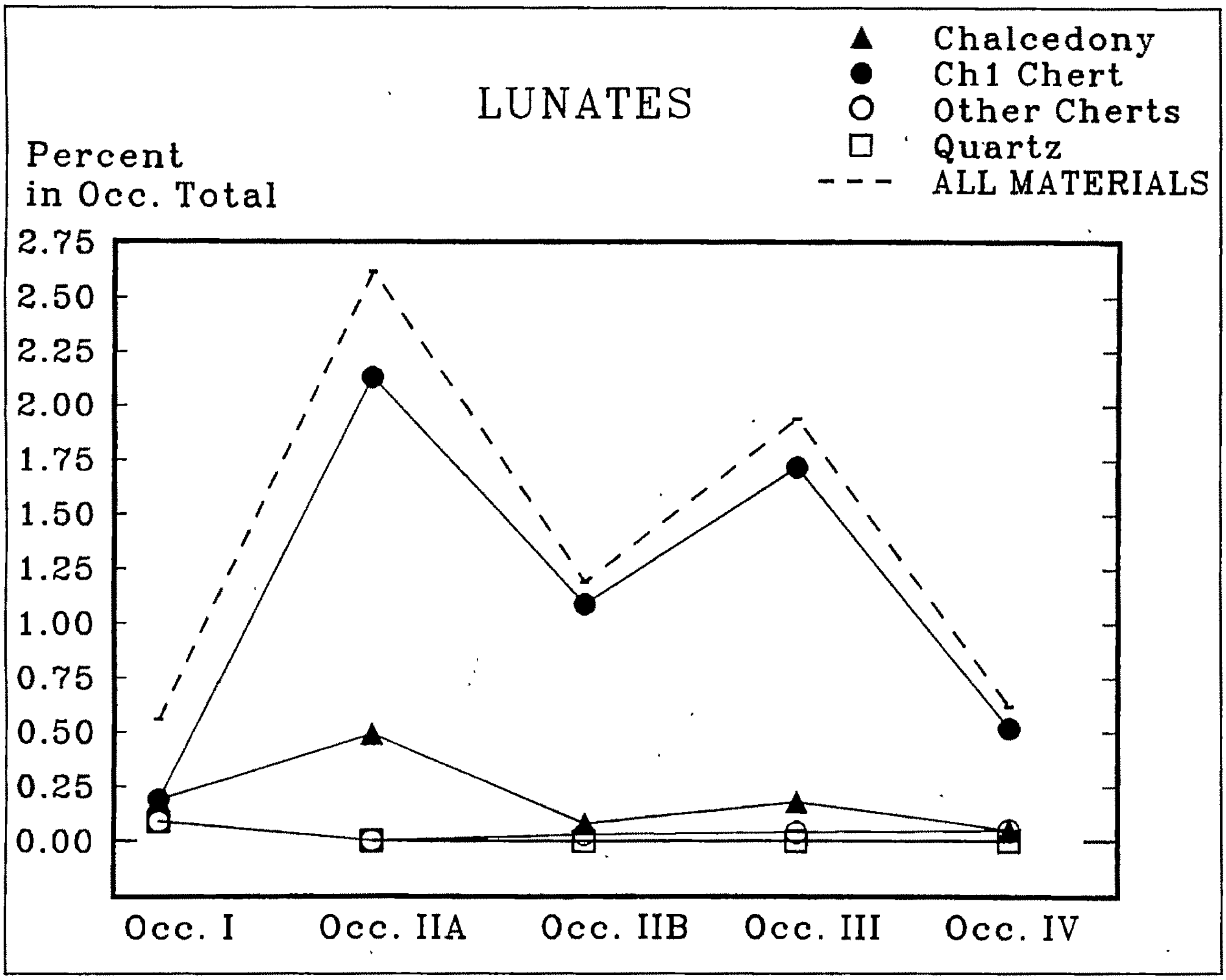

Fig. 6: Per cent of lunates and lunate fragments in total chipped-stone, by occupation, all material categories

for this occupation fall between 2700 and 2300 B.C. (Deavaraj *et al.* 1995). In addition to chipped-stone tools and debris, many other artefact categories are present, such as handmade pottery, groundstone tools, shell objects, faunal remains, and charcoal. Chipped-stone from Occupation IIA comprises only 10% of the total material in this analysis. Although this quantity is little more than in Occupation I, the frequencies of specimen types and material subgroups in the Occupation IIA material profile are quite different, and bear a much closer resemblance to later occupations.

For all materials combined (Table 1), it can be seen that in Occupation IIA the relative frequencies of all blades, blade cores, and lunates in the assemblage rise steeply from the previous occupation. In the category of blades, the frequencies of Other Cherts and Quartz decrease, while that of Chalcedony is double that of the previous occupation. Most of the increase, however, is due to the dramatic increase in the Ch1 Chert subcategory, where Ch1 Chert blades and blade fragments jump from 1% to almost 30% of the occupation total. In sharp contrast to the previous occupation, Ch1 Chert blades now exceed Chalcedony blades by a ratio of more than 4 to 1.

Turning to blade cores, Occupation IIA examples increase in number, but represent less than 2% of the total for this occupation (and in any material are less than 1 percent). A clear majority of the 21 blade cores and blade core fragments are Ch1 Chert or Chalcedony. Finally, for lunates, the subcategories of Chalcedony and Ch1 Chert lunates are at their peak values here, together bringing the combined total of lunates to its highest frequency in any occupational assemblage, despite the absence of lunates of other materials. Ch1 Chert appears to be the preferred material for lunate manufacture.

Occupation IIB Material Profile

Occupation IIB spans the period between 2300 and 2000 B.C., as determined by radiocarbon dating. Artefacts of all

Table 2: Intact blades, length in mm

BLADE LENGTH	Number	Minimum	Maximum	Mean	Standard Deviation
Occupation I					
Chalcedony	13	18.1	29.6	22.36	3.80
Chl Chert	2	18.2	19.6	18.9	0.99
Other Cherts	7	22.3	45.2	32.37	7.26
Quartz	9	18.6	41.1	27.24	6.84
Occupation IIA					
Chalcedony	39	15.0	39.1	21.21	5.69
Chl Chert	40	13.8	71.7 *	31.09	11.31
Other Cherts	1	53.9	-	53.9	-
Quartz	4	9.9	23.5	19.75	6.58
Occupation IIB					
Chalcedony	191	4.8	36.1	21.63	5.56
Chl Chert	165	8.8	96.4 **	28.34	10.79
Other Cherts	2	19.7	24.4	22.05	3.32
Quartz	-	-	-	-	-
Occupation III					
Chalcedony	92	12.8	37.7	25.10	5.40
Chl Chert	307	10.0	56.0	27.45	8.64
Other Cherts	5	23.7	41.0	33.42	7.28
Quartz	-	-	-	-	-
Occupation IV					
Chalcedony	12	13.4	37.1	24.68	7.17
Chl Chert	108	12.2	49.1	26.26	9.01
Other Cherts	2	17.2	22.6	19.9	3.82
Quartz	1	18.2	-	18.2	-

* Occ. IIA next lower value: 53.8 mm

** Occ. IIB next lower value: 53.2 mm

Table 3: Intact blades, width in mm

BLADE WIDTH	Number	Minimum	Maximum	Mean	Standard Deviation
Occupation I					
Chalcedony	13	5.2	14.8	8.82	2.57
Chl Chert	2	5.5	8.2	6.85	1.91
Other Cherts	7	9.3	22.6	13.11	4.43
Quartz	9	6.1	13.8	10.3	3.32
Occupation IIA					
Chalcedony	39	3.9	10.3	6.10	1.46
Chl Chert	40	4.8	18.4	8.64	3.34
Other Cherts	1	8.4	-	8.4	-
Quartz	4	1.6	9.9	5.95	3.40
Occupation IIB					
Chalcedony	191	3.5	25.8	6.55	1.90
Chl Chert	165	1.3	20.2	7.53	2.55
Other Cherts	2	6.5	10.4	8.45	2.76
Quartz	-	-	-	-	-
Occupation III					
Chalcedony	92	2.5	12.5	7.17	1.70
Chl Chert	307	1.5	25.1	7.17	2.32
Other Cherts	5	6.7	9.0	7.66	0.97
Quartz	-	-	-	-	-
Occupation IV					
Chalcedony	12	4.8	8.6	6.92	1.07
Chl Chert	108	3.3	13.2	6.97	1.86
Other Cherts	2	6.5	6.9	6.7	0.28
Quartz	1	6.4	-	6.4	-

categories, including chipped-stone, are common and diverse (Deavaraj *et al.* 1995: 64), and Occupation IIB materials comprise 30% of all chipped-stone in this analysis. Although this occupation includes quantitatively much more chipped-stone than previously, the relative frequencies in the three morphological categories do not appear much different from those of Occupation IIA (Table 1), and there is a continuation of previously evident trends. It is only on inspection of the material subcategories that clear dissimilarities can be seen.

Chl Chert blades remain stable at about 30% of the Occupation IIB total, and continue to exceed those of

Chalcedony. However, the frequency of Chalcedony blades more than doubles, reaching its maximum in any occupation, and appearing to reflect an intensification in the production of blades of this material. This increase brings the combined blade total near its peak (which occurs in the subsequent occupation), and brings the ratio of Ch1 Chert to Chalcedony blades down to less than 3 to 1. Concomitantly, the frequency of blades of Other Cherts in the occupation total continues to decline, and Quartz examples are absent entirely.

For blade cores, the combined frequency for all materials in this occupational assemblage reaches its maximum for any occupation. This is reflected in the increase in Chalcedony (also at its maximum for any occupation), as well as an increase in Ch1 Chert. The overall quantity of blade cores and blade core fragments (83) more than triples, to its maximum value in any assemblage. Blade cores are almost exclusively Ch1 Chert or Chalcedony, with no Quartz and only minor examples of Other Cherts. In contrast to the increases in Chalcedony and Ch1 Chert blades and blade cores, the relative frequencies of lunates of these materials decline sharply from their peak values in the previous occupation.

Occupation III Material Profile

In the absence of radiocarbon dates, Occupation III has been tentatively concluded to post-date 2000 B.C. (Deavaraj *et al.* 1995). All types of artefacts are abundant; and the greatest quantity, 36%, of chipped-stone in this analysis belongs to this occupation. Despite this overall increase in the total amount of chipped-stone, the combined frequencies of blades, blade cores, and lunates in this assemblage do not differ greatly from those of the previous occupation (Table 1). Again, it is in the material subcategories that clearer distinctions between the occupations can be made. In Occupation III, the use of Quartz and Other Cherts is negligible, Chalcedony examples decline sharply. Ch1 Chert is clearly the predominant material in all three artefact categories.

Occupation III has the highest frequency of blades in any occupational assemblage, although the difference from the previous one is less than half of one per cent. This peak is entirely due to an increase in the occurrence of Ch1 Chert blades sufficient to offset the 50% decline in Chalcedony blades; here the ratio of Ch1 Chert to Chalcedony blades is almost 7 to 1.

Blade cores mirror the decline in Chalcedony as well; and the combined blade core percentage remains relatively stable primarily due to an increase in the frequency of Ch1 Chert cores. Here too, almost all of the 92 blade cores and blade core fragments are made of Ch1 Chert or Chalcedony. In contrast, the frequencies of lunates of all materials increase somewhat from Occupation IIB; nevertheless, Ch1 Chert lunates exhibit the greatest increase.

Occupation IV Material Profile

Occupation IV, the last occupation at Watgal, is estimated to date sometime after 1000 B.C. Within this occupation there is an apparent decline in the diversity and density of most artefact categories; the only exception is a significant density increase in pottery (Deavaraj *et al.* 1995). While there is definitely a reduction in number of artefact types, future analysis, based upon recalculated soil volumes from the additional excavated units, may alter this perception of a decline in artefact densities. In any case, the chipped-stone of Occupation IV reflects this apparent decline, and comprises only 15% of the analysis total.

Although the quantity of chipped-stone in Occupation IV is much less than in Occupation III, there is still a resemblance to the previous occupation in artefact frequencies (Table 1). Throughout, the use of Other Cherts and Quartz in all artefact categories remains negligible For blades, the combined frequency declines slightly, though still remaining close to the peak in Occupation III. Here again, another drop in the subcategory of Chalcedony is offset by an increase in Ch1 Chert. In this occupation the frequency of Ch1 Chert peaks, blades and blade fragments of this material alone comprising more than 40% of *all* chipped-stone. The ratio of Ch1 Chert to Chalcedony blades exceeds 13 to 1.

Blade cores do not follow this pattern precisely, although their overall percentage in the Occupation IV assemblage does drop. The frequency of Ch1 Chert blade cores actually declines, while the frequency of Chalcedony cores increases slightly. All of the 35 blade cores and blade core fragments in this occupation are Ch1 Chert or Chalcedony. The greatest distinction from the previous occupation, and the sharpest decline, is in the category of lunates, where the frequencies for lunates of all materials combined, and for the subcategories of Ch1 Chert and Chalcedony, exhibit their lowest values for any occupation subsequent to Occupation I.

This superficial classification, separation, and quantification of the chipped-stone specimens of each occupation into subcategories by material and morphology, with the calculation of the relative frequencies of these subcategories, permits a general comparison of the chipped-stone assemblages of these occupations. For each occupation, the relative occurrence of subcategories of selected artefacts of various materials provides a "material profile" specific to the occupation. Comparisons of these profiles reveal changes through time in the types of artefacts made and the choices of materials used, thus illuminating strategic changes in the manufacture of stone tools at Watgal. However, these general artefact subcategories reveal nothing about changes in the forms of the artefacts themselves. To determine if such changes occurred in these chipped-stone artefacts, closer examination is required.

Table 4: Intact blade cores, length in mm

BLADE CORE LENGTH	Number	Minimum	Maximum	Mean	Standard Deviation
Occupation I					
Chalcedony	-	-	-	-	-
Chl Chert	-	-	-	-	-
Other Cherts	-	-	-	-	-
Quartz	2	22.0	35.7	28.85	9.69
Occupation IIA					
Chalcedony	4	14.6	21.6	17.83	2.91
Chl Chert	6	19.4	31.3	25.47	4.58
Other Cherts	1	23.3	-	23.3	-
Quartz	1	32.4	-	32.4	-
Occupation IIB					
Chalcedony	27	13.6	34.0	21.52	5.46
Chl Chert	20	18.5	46.1	29.57	7.60
Other Cherts	1	31.6	-	31.6	-
Quartz	-	-	-	-	-
Occupation III					
Chalcedony	10	12.8	32.3	21.66	7.48
Chl Chert	37	16.8	50.0	28.37	7.41
Other Cherts	1	38.8	-	38.8	-
Quartz	-	-	-	-	-
Occupation IV					
Chalcedony	5	19.3	30.0	24.14	4.75
Chl Chert	17	18.4	44.0	30.68	6.58
Other Cherts	-	-	-	-	-
Quartz	-	-	-	-	-

Artefact Comparisons: Methods

As described above, blades, blade cores, and lunates from each occupation were sorted into four material subgroups: Chalcedony, Chl Chert, Other Cherts, and Quartz. Lengths and widths were recorded for the measured intact blades and lunates, as were the lengths of unbroken blade cores.

All measurements were taken to the nearest 0.1 mm. Mean values and standard deviations were calculated for the measurements in each material subgroup, and these are listed in Tables 2 through 6, together with minimum and maximum values for each subgroup within each occupation.

Table 5: Intact lunates, length in mm

LUNATE LENGTH	Number	Minimum	Maximum	Mean	Standard Deviation
Occupation I					
Chalcedony	-	-	-	-	-
Chl Chert	1	23.4	-	23.4	-
Other Cherts	1	26.7	-	26.7	-
Quartz	1	14.7	-	14.7	-
Occupation IIA					
Chalcedony	5	13.1	25.1	18.94	4.31
Chl Chert	15	7.1	26.0	20.53	4.97
Other Cherts	-	-	-	-	-
Quartz	-	-	-	-	-
Occupation IIB					
Chalcedony	2	19.1	21.1	20.10	1.41
Chl Chert	27	14.5	38.8	23.64	5.12
Other Cherts	-	-	-	-	-
Quartz	-	-	-	-	-
Occupation III					
Chalcedony	3	16.3	29.0	21.53	6.64
Chl Chert	33	16.3	42.5	28.07	6.50
Other Cherts	1	26.4	-	26.4	-
Quartz	-	-	-	-	-
Occupation IV					
Chalcedony	1	31.2	-	31.2	-
Chl Chert	2	28.8	31.0	29.90	1.56
Other Cherts	1	19.9	-	19.9	-
Quartz	-	-	-	-	-

The two-sample t-test (Thomas 1986: 235-240) was used to compare artefact subgroups containing more than one specimen. This test compares the means and standard deviations of two samples to determine the probability that they might derive from the same population. This is advisable because two samples, even if derived from the same population, will almost always have different means, due to sampling error. The two-sample t-test assesses the likelihood that a difference between the means of two samples should be attributed to chance alone. A high probability value for the calculated t value indicates that the samples are more likely to have been derived from the

Table 6: Intact lunates, width in mm

LUNATE WIDTH	Number	Minimum	Maximum	Mean	Standard Deviation
Occupation I					
Chalcedony	-	-	-	-	-
Chl Chert	1	5.5	-	5.5	-
Other Cherts	1	9.3	-	9.3	-
Quartz	1	6.4	-	6.4	-
Occupation IIA					
Chalcedony	5	4.4	6.7	5.56	1.07
Chl Chert	15	4.4	7.7	5.37	0.97
Other Cherts	-	-	-	-	-
Quartz	-	-	-	-	-
Occupation IIB					
Chalcedony	2	5.2	5.4	5.30	0.14
Chl Chert	27	1.5	7.7	5.33	1.22
Other Cherts	-	-	-	-	-
Quartz	-	-	-	-	-
Occupation III					
Chalcedony	3	4.0	5.0	4.40	0.53
Chl Chert	33	3.0	6.1	4.43	0.80
Other Cherts	1	7.3	-	7.3	-
Quartz	-	-	-	-	-
Occupation IV					
Chalcedony	1	4.3	-	4.3	-
Chl Chert	2	3.6	4.0	3.80	0.28
Other Cherts	1	3.9	-	3.9	-
Quartz	-	-	-	-	-

same population, whereas a low probability value for the calculated t value indicates that the samples are more likely to be from two different populations.

For this analysis, the test was used in two ways. Comparisons were made between groups of artefacts of different stone types from the same occupation to determine if there were statistically significant differences between groups of artefacts made, at roughly the same time, of different materials. Comparisons were also made between groups of artefacts of the same stone type from adjacent occupations to determine if there were significant differences between artefacts made of the same materials at

Table 7: Intact blade length comparisons, by material and occupation

Blade Length Sample 1	Blade Length Sample 2	Calculated t Value	Degrees of Freedom	Probability (p ≤)	Significant
Chl Occ I	Chl Occ IIA	1.50632	40	0.0699	
Chl Occ IIA	Chl Occ IIB	1.43261	203	0.0767	
Chl Occ IIB	Chl Occ III	0.97608	470	0.1647	
Chl Occ III	Chl Occ IV	1.21737	413	0.1121	
Chal Occ I	Chal Occ IIA	0.62916	50	0.2661	
Chal Occ IIA	Chal Occ IIB	0.42821	228	0.3345	
Chal Occ IIB	Chal Occ III	4.96362	281	0.0000 +	Yes
Chal Occ III	Chal Occ IV	0.24365	102	0.4040	
Chl Occ I	Chal Occ I	1.19357	13	0.1270	
Chl Occ IIA	Chal Occ IIA	4.88529	77	0.0000 +	Yes
Chl Occ IIB	Chal Occ IIB	7.51750	354	0.0000 +	Yes
Chl Occ III	Chal Occ III	2.46718	397	0.0070	Yes
Chl Occ IV	Chal Occ IV	0.58646	118	0.2793	
Oth Occ I	Chl Occ I	2.49560	7	0.0206	
Oth Occ I	Chal Occ I	4.10021	18	0.0003	Yes
Oth Occ I	Qua Occ I	1.59561	14	0.0664	
Qua Occ I	Chl Occ I	1.65218	9	0.0664	
Qua Occ I	Chal Occ I	2.17330	20	0.0210	

different times. The comparisons made between groups, with the calculated t values, degrees of freedom and associated probabilities, are listed in Tables 7 through 11. Probabilities in these tables were calculated for one-tailed tests.

A variation of the same test was used to determine the probability that an isolated specimen might belong to the same population as a separate sample (Thomas 1986: 240-241). This test compares a measurement of a single artefact with the mean value and standard deviation of the measurements of a separate group. This test was also used in the two ways described above: to compare a single artefact of one stone type with a group of artefacts of a different material from the same occupation, or to compare it to the mean value for a group of artefacts of the same material from an adjacent occupation. Results of these tests are also listed in Tables 7 through 11.

Blade Measurements

For this analysis the intact blades of each occupation at Watgal were sorted by stone type into the four material subgroups. Lengths and widths were recorded to the nearest 0.1 mm for the measured intact blades. For all material subgroups, the blades were counted, the minimum and maximum values were recorded, and the means and standard deviations were calculated separately. Tables 2 and 3 list this information, and Tables 7 and 8 list the test results for the comparisons of blade lengths and widths. The ranges of variation for the Chalcedony and Chl Chert subgroups are plotted in Figures 7 and 8.

Table 8: Intact blade width comparisons, by material and occupation

Blade Width Sample 1	Blade Width Sample 2	Calculated t Value	Degrees of Freedom	Probability ($p \leq$)	Significant
Ch1 Occ I	Ch1 Occ IIA	0.74595	40	0.2300	
Ch1 Occ IIA	Ch1 Occ IIB	2.31583	203	0.0108	Yes
Ch1 Occ IIB	Ch1 Occ III	1.55215	470	0.0607	
Ch1 Occ III	Ch1 Occ IV	0.72018	413	0.2359	
Chal Occ I	Chal Occ IIA	4.74399	50	0.0000 +	Yes
Chal Occ IIA	Chal Occ IIB	1.39635	228	0.0820	
Chal Occ IIB	Chal Occ III	2.65861	281	0.0041	Yes
Chal Occ III	Chal Occ IV	0.49554	102	0.3106	
Ch1 Occ I	Chal Occ I	1.02703	13	0.1616	
Ch1 Occ IIA	Chal Occ IIA	4.35987	77	0.0000 +	Yes
Ch1 Occ IIB	Chal Occ IIB	4.14435	354	0.0000 +	Yes
Ch1 Occ III	Chal Occ III	0.00223	397	0.4991	
Ch1 Occ IV	Chal Occ IV	0.35259	118	0.3625	
Oth Occ I	Ch1 Occ I	1.87483	7	0.0515	
Oth Occ I	Chal Occ I	2.76603	18	0.0063	Yes
Oth Occ I	Qua Occ I	1.44944	14	0.0846	
Qua Occ I	Ch1 Occ I	1.27720	9	0.1167	
Qua Occ I	Chal Occ I	0.96593	20	0.1728	

Occupation I Blades

In Occupation I the Ch1 Chert subgroup has the smallest mean values for both length and width, and the Other Cherts subgroup has the largest (Tables 2 and 3). The length and width means of the Other Cherts subgroup were compared to those of the Ch1 Chert subgroup, the Chalcedony subgroup, and the Quartz subgroup, respectively. Statistically significant differences in length and width were found between Chalcedony and Other Cherts ($p < 0.001$). Although the length and width means for Chalcedony blades are greater than those of Ch1 Chert, on comparison these differences were not shown to be statistically significant, reflecting perhaps the scarcity of Ch1 Chert blades in this occupation.

Occupation IIA Blades

In Occupation IIA the Quartz blade subgroup has the smallest mean length (Tables 2 and 3). Other Cherts has the largest mean length, despite the fact that one blade in the Ch1 Chert subgroup measures 71.7 mm in length. This is clearly an outlier, as the next largest Ch1 Chert blade is 53.8 mm in length. The Quartz subgroup also exhibits the smallest mean width, but Ch1 Chert has the largest.

The first set of tests compared blades of different materials within Occupation IIA. Ch1 Chert blades were both longer and wider on average than Chalcedony blades, and these differences were shown to be statistically significant ($p < 0.001$). The second set of tests compared these blades with the corresponding Occupation I groups.

Table 9: Intact blade core length comparisons, by material and occupation

Blade Core Sample 1	Blade Core Sample 2	Calculated t Value	Degrees of Freedom	Probability (p ≤)	Significant
Chl Occ IIA	Chl Occ IIB	1.24447	24	0.1127	
Chl Occ IIB	Chl Occ III	0.57834	55	0.2827	
Chl Occ III	Chl Occ IV	1.10035	52	0.1381	
Chal Occ IIA	Chal Occ IIB	1.31091	29	0.1001	
Chal Occ IIB	Chal Occ III	0.06257	35	0.4752	
Chal Occ III	Chal Occ IV	0.66995	13	0.2573	
Chl Occ IIA	Chal Occ IIA	2.93288	8	0.0095	Yes
Chl Occ IIB	Chal Occ IIB	4.22994	45	0.0000 +	Yes
Chl Occ III	Chal Occ III	2.53591	35	0.0074	Yes
Chl Occ IV	Chal Occ IV	2.05453	20	0.0266	
Chal Occ IIA	Chal Occ IV	2.31411	7	0.0269	
Chl Occ IIA	Chl Occ IV	1.78026	21	0.0447	

Table 10: Intact lunate length comparisons, by material and occupation

Lunate Length Sample 1	Lunate Length Sample 2	Calculated t Value	Degrees of Freedom	Probability (p ≤)	Significant
Chl Occ I	Chl Occ IIA	0.81666	14	0.2139	
Chl Occ IIA	Chl Occ IIB	1.90558	40	0.0320	
Chl Occ IIB	Chl Occ III	2.88304	58	0.0028	Yes
Chl Occ III	Chl Occ IV	0.39225	33	0.3487	
Chal Occ IIA	Chal Occ IIB	0.66092	5	0.2689	
Chal Occ IIB	Chal Occ III	0.08592	3	0.4674	
Chal Occ III	Chal Occ IV	2.05955	2	0.0878	
Chl Occ IIA	Chal Occ IIA	0.63733	18	0.2660	
Chl Occ IIB	Chal Occ IIB	0.68885	27	0.2484	
Chl Occ III	Chal Occ III	1.66639	34	0.0524	
Chl Occ IV	Chal Occ IV	1.17851	1	0.2240	

Table 11: Intact lunate width comparisons, by material and occupation

Lunate Width Sample 1	Lunate Width Sample 2	Calculated t Value	Degrees of Freedom	Probability (p ≤)	Significant
Ch1 Occ I	Ch1 Occ IIA	0.18953	14	0.4262	
Ch1 Occ IIA	Ch1 Occ IIB	0.05454	40	0.4784	
Ch1 Occ IIB	Ch1 Occ III	3.66241	58	0.0003	Yes
Ch1 Occ III	Ch1 Occ IV	1.09608	33	0.1405	
Chal Occ IIA	Chal Occ IIB	0.32402	5	0.3795	
Chal Occ IIB	Chal Occ III	2.23953	3	0.0555	
Chal Occ III	Chal Occ IV	0.26683	2	0.4073	
Ch1 Occ IIA	Chal Occ IIA	0.37049	18	0.3577	
Ch1 Occ IIB	Chal Occ IIB	0.10256	27	0.4595	
Ch1 Occ III	Chal Occ III	0.06324	34	0.4750	
Ch1 Occ IV	Chal Occ IV	2.52538	1	0.1200	

No statistically significant differences were found between the Ch1 Chert blade mean lengths and widths of both occupations; nor in the mean lengths of the Chalcedony blades. However, the Occupation IIA Chalcedony blades were shown to be significantly narrower ($p < 0.001$) than the Chalcedony blades of Occupation I.

Occupation IIB Blades

In Occupation IIB the Chalcedony subgroup has the smallest means for both length and width, and Ch1 Chert the largest (Tables 2 and 3). There is again one outlier in the Ch1 Chert subgroup, measuring 96.4 mm: the next largest measures 53.2 mm. Within the occupation, Ch1 Chert blades continue to be significantly longer and wider ($p < 0.001$) than those of Chalcedony. In comparing the blades of Occupation IIB with those of IIA, the differences between the mean lengths and widths of Chalcedony blades were not found to be statistically significant, nor were the mean lengths for Ch1 Chert blades. However, Ch1 Chert blades in Occupation IIB were found to be significantly narrower ($p = 0.0108$) than those of Occupation IIA.

Occupation III Blades

In Occupation III the Chalcedony subgroup exhibits the smallest mean length and mean width, and Other Cherts the largest (Tables 2 and 3). Within Occupation III, Ch1 Chert blades still appear longer on average than Chalcedony blades, and this difference is still significant ($p < 0.01$). However, there is no longer a statistically significant difference in the mean widths of these subgroups. In comparing Occupations IIB and III, the differences between the means for Ch1 Chert blade lengths and widths are not statistically significant. However, Occupation III Chalcedony blades are significantly longer and wider ($p < 0.001$ and $p < 0.01$, respectively) than those of Occupation IIB.

Occupation IV Blades

In Occupation IV the measurements of the single Quartz blade are smaller than the mean lengths and widths of the other subgroups, while the Ch1 Chert subgroup has the largest mean lengths and widths (Tables 2 and 3). Within Occupation IV Ch1 Chert blades still appear to be longer and wider than those of Chalcedony, but the differences are not statistically significant. In comparing Occupation III with Occupation IV, no statistically significant differences were seen between the lengths and widths of the Ch1 Chert blade subgroups, nor between those of the Chalcedony blade subgroups.

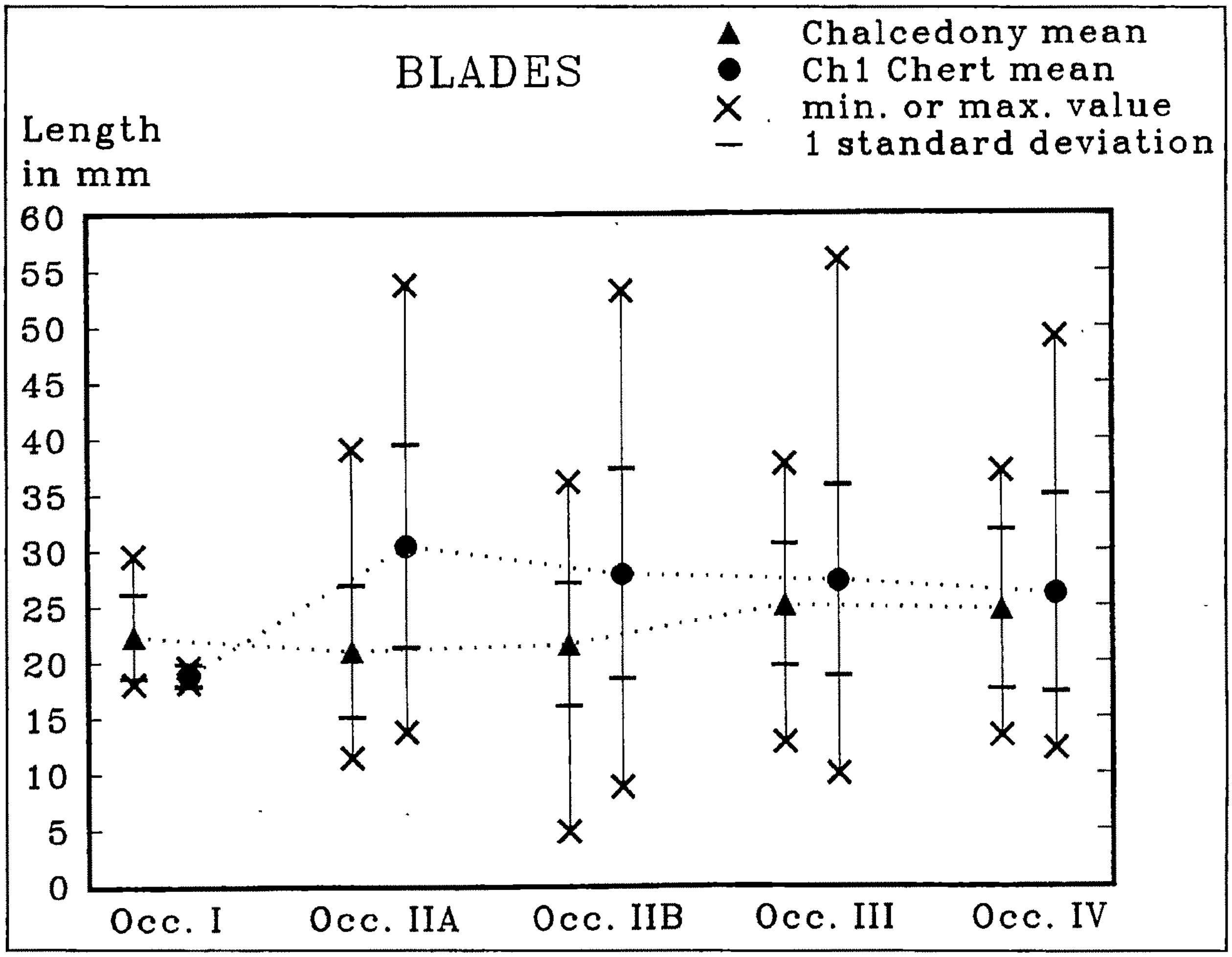

Fig. 7: Intact blade lengths: mean, minimum, and maximum values, with standard deviations, chalcedony and Ch1 chert

Blade Core Measurements

The length data for intact blade cores is presented in Table 4, which lists for each material subgroup the quantity measured, the minimum and maximum values, and the mean and standard deviation. Table 9 lists the test results for the comparison of blade core lengths. The ranges of variation for the Chalcedony and Ch1 Chert subgroups are plotted in Fig. 9.

Occupation I Blade Cores

While fragmentary examples of blade cores exist in all material subgroups, most unfortunately no length measurements could be taken on any intact Chalcedony and chert specimens. Measurements of the two intact Quartz blade cores are recorded in Table 4.

Occupation IIA Blade Cores

All four material subgroups appear in Occupation IIA, although both Quartz and Other Cherts are each represented by only one example, measuring 32.4 mm and 23.3 mm, respectively. Mean lengths of Ch1 and Chalcedony blade cores within Occupation IIA were statistically compared, and Ch1 Chert blade cores were found to be significantly longer ($p < 0.01$) than Chalcedony blade cores.

Occupation IIB Blade Cores

No Quartz examples have yet been found in Occupation IIB, and only a single example in the subcategory of Other Cherts. Within the occupation, Ch1 Chert blade cores remain significantly longer ($p < 0.001$) than those of Chalcedony. No significant difference was found between the Chalcedony blade cores of Occupation IIB and the previous occupation, nor between the Ch1 Chert blade cores of Occupation IIB and the previous occupation.

Occupation III Blade Cores

There are no Quartz blade cores in Occupation III, and only a single measured example of Other Cherts. Within

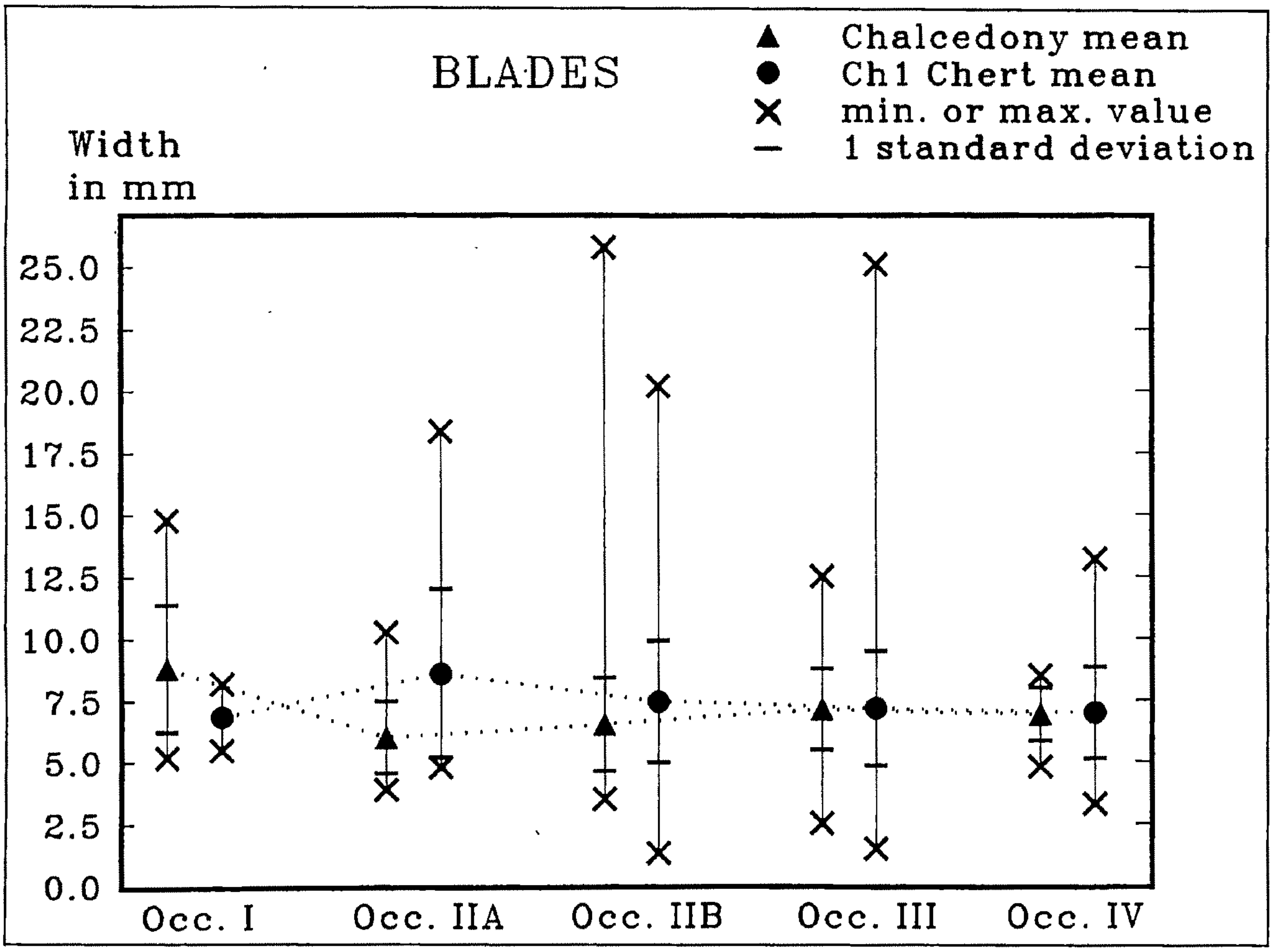

Fig. 8: Intact blade widths. mean, minimum, and maximum values, with standard deviations, chalcedony and Ch1 chert

the occupation, the previously noted difference between the longer Ch1 Chert blade cores and the shorter Chalcedony blade cores remains significant ($p < 0.01$). As before, no significant difference was found between the Chalcedony subgroups in Occupation IIB and III, nor between the Ch1 Chert subgroups in the same occupations.

Occupation IV Blade Cores

In Occupation IV only two material subgroups are represented, Ch1 Chert and Chalcedony. Within the occupation, for the first time Ch1 Chert blade cores are not found to be significantly longer on average than Chalcedony blade cores at $p < 0.01$. They do test as statistically significant at the $p < 0.03$ level. Comparing Occupation IV with Occupation III, the differences between the Chalcedony means, and also the Ch1 Chert means, were not significant. Interestingly, however, in considering a wider time span, that is, comparing the Chalcedony blade cores of Occupation IIA with those of Occupation IV, the difference in means was found to be significant at the $p < 0.03$ level. The difference between Ch1 Chert blade cores from these occupations was also found to be significant at the $p < 0.05$ level.

Lunate Measurements

Tables 5 and 6 present the quantities, the minimum and maximum lengths and widths, and the means and standard deviations for the material subgroups of intact lunates. Test results are listed in Tables 10 and 11. The ranges of variation for the Chalcedony and Ch1 Chert subgroups in each occupation are plotted in Figures 10 and 11.

Occupation I Lunates

Lunates are rarely found in Occupation I. Only three intact specimens could be measured, one each in Ch1 Chert, Quartz, and Other Cherts. Nevertheless, all material subgroups are represented in the small number of identifiable damaged and fragmentary lunates.

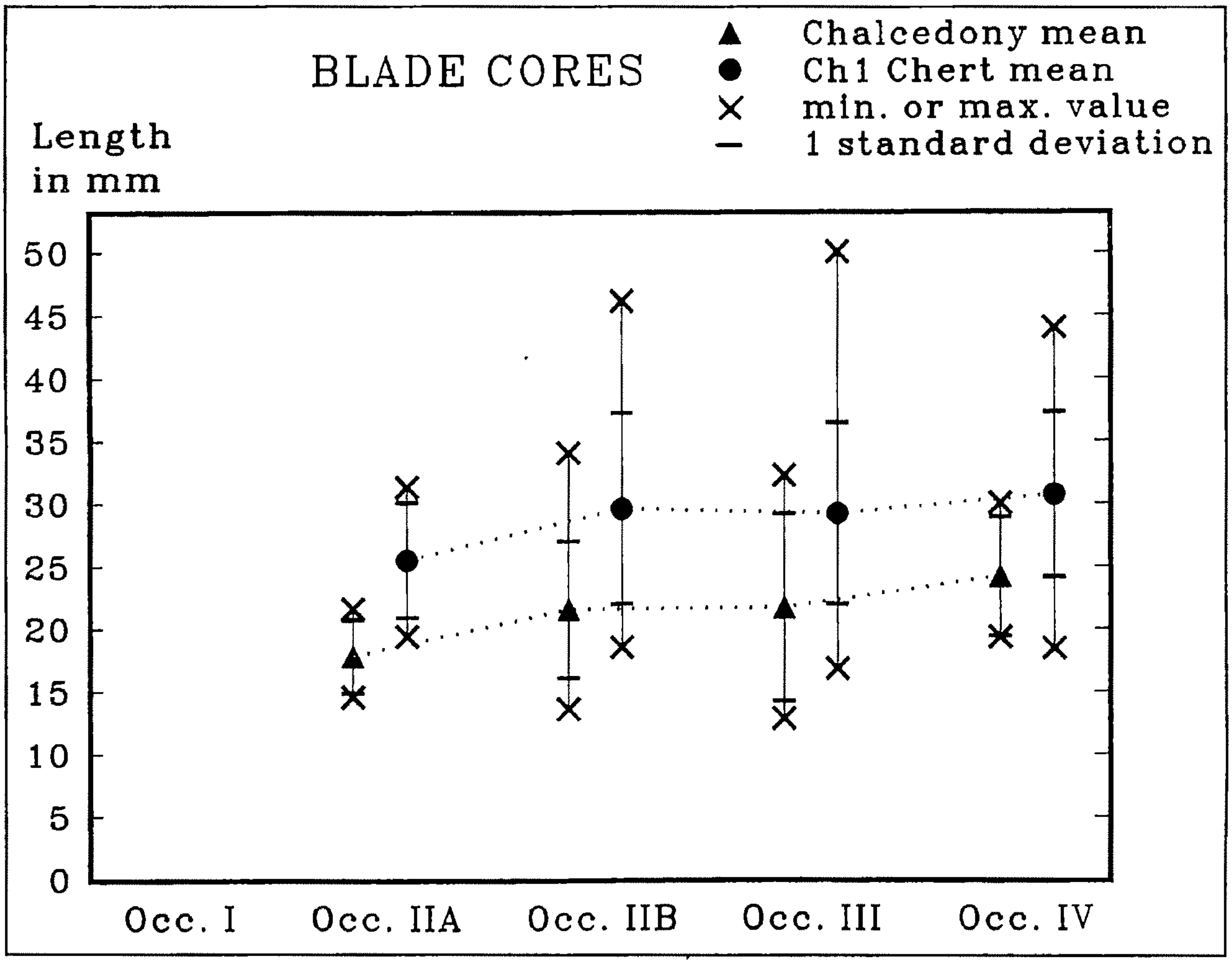

Fig. 9: Intact blade core lengths: mean, minimum, and maximum values, with standard deviations, chalcedony and Ch1 chert

Occupation IIA Lunates

No lunates, whether intact or damaged, of Other Cherts or Quartz were found in this occupation. Although there is a sharp increase in the total number of specimens from the previous Occupation, all are made of either Ch1 Chert or Chalcedony. Within Occupation IIA the means of length and width for the Chalcedony lunates were not found to be significantly different from those of the Ch1 Chert lunates. Likewise, in comparing adjacent occupations, the single Ch1 Chert lunate of Occupation I was not significantly different in length and width from the Ch1 Chert lunates of Occupation IIA.

Occupation IIB Lunates

No intact lunate of a material other than Ch1 Chert or Chalcedony was found in Occupation IIB, although there is a single damaged specimen of Other Cherts. Within this occupation, there were no significant differences between the lengths and widths of Chalcedony and Ch1 Chert lunates. Nor were there significant differences from the lunates of the previous occupation.

Occupation III Lunates

Only two lunates of a material other than Ch1 Chert or Chalcedony were found in Occupation III. Both were classed as Other Cherts: one was intact and measured, the other was not. Within the occupation there continued to be no significant differences between the lengths and widths of Chalcedony and Ch1 Chert lunates. In comparison with the previous occupation, the Occupation III Chalcedony lunates were not significantly different from those of the previous occupation. However, the Ch1 Chert lunates for Occupation III were found to be significantly longer and narrower ($p < 0.01$) than the Ch1 Chert lunates of Occupation IIB.

Occupation IV Lunates

In Occupation IV, only one lunate of a material other than

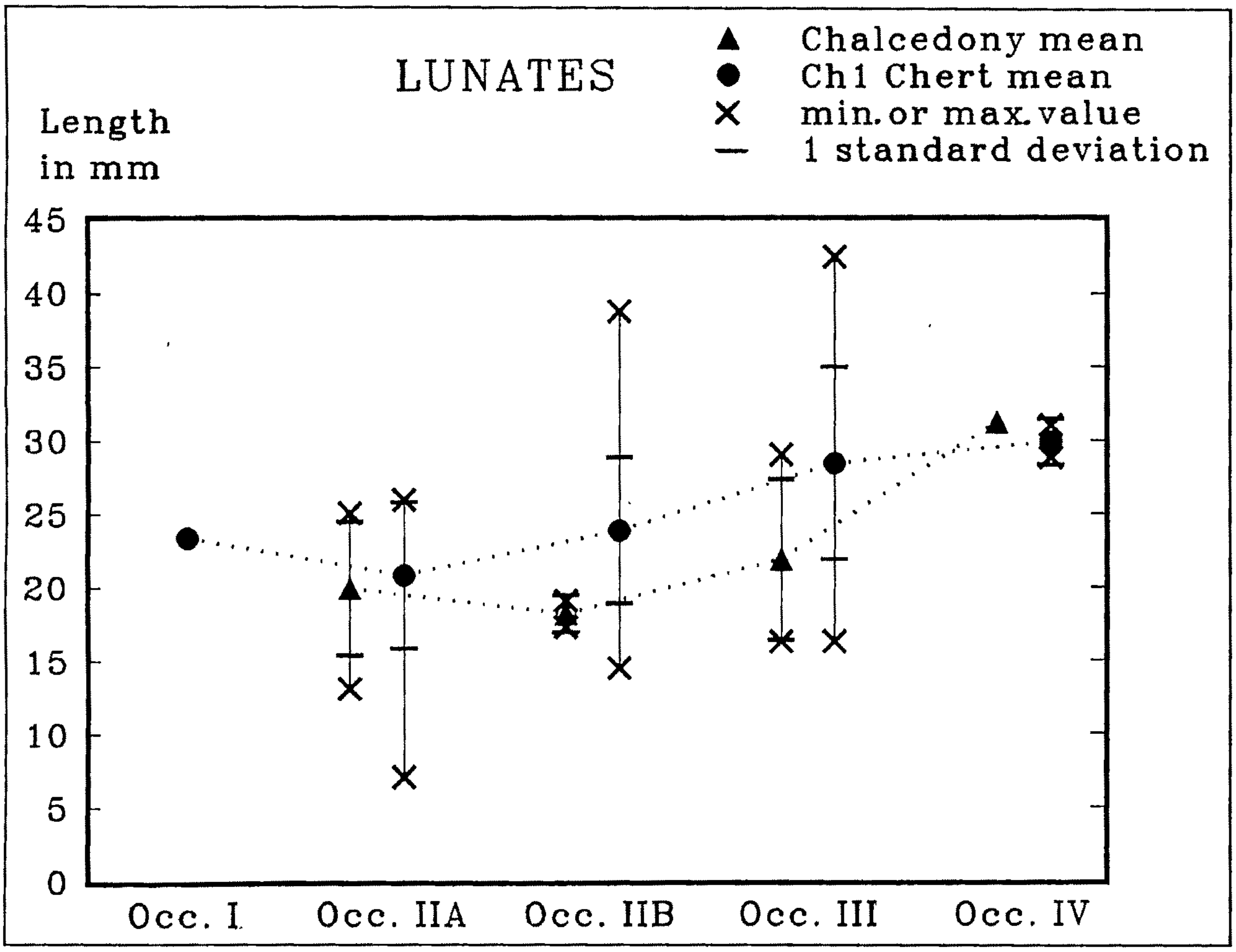

Fig. 10· Intact lunate lengths. mean, minimum, and maximum values, with standard deviations, chalcedony and Ch1 chert

Ch1 Chert or Chalcedony was found. Four intact lunates were measured. The single Chalcedony lunate and the single Other Cherts lunate were not shown to be significantly different in length or width than the two examples of Ch1 Chert. None of these varied significantly from the lunates of the previous occupation.

The preceding descriptions of selected artefact categories have been made in an attempt to characterize these artefacts within the chipped-stone assemblage of each occupation at Watgal. The perceived differences between them are here interpreted as changes in the methods and materials used in their manufacture. However, it is possible that changes in the use of the site over time may have also affected the distribution of chipped-stone in each occupation. In any consideration of the site as a whole, the importance of the differences found in this study must be balanced against other factors at Watgal, such as the presence and type of other artefact classes, the presence and type of features, and so on, before their overall cultural significance can be assessed.

Conclusions

In South Asian archaeology, the analytical attention given to lithic tools in interpreting cultural relationships usually diminishes with the appearance of ceramic technology in the archaeological record at any site. The identification of exotic lithic imports has always been important, of course, and recent developments in microwear studies have added greatly to our understanding of lithic technology. However, the majority of studies relegate lithic analytical discussion to a descriptive typology accompanied by quantification of a sample retrieved by field methods that often ignored issues of statistical importance. This situation certainly reflects the Southern Neolithic context, where discussions focus on typologies based on complete artefacts selected from a non-randomly collected sample. These discussions are sometimes accompanied by comments on the natural beauty of the material involved and the craftsperson's knapping skills, but little else.

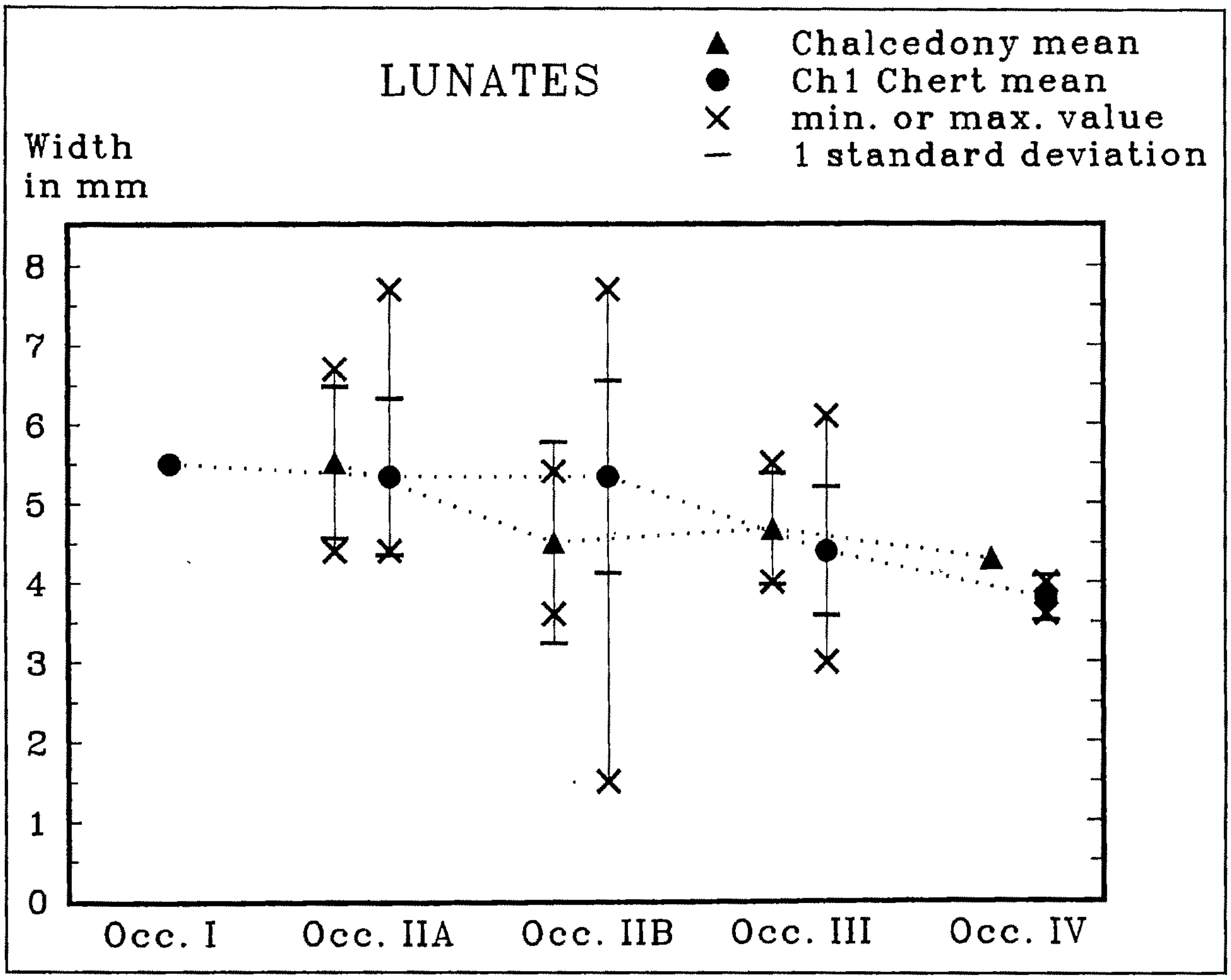

Fig. 11: Intact lunate widths: mean, minimum, and maximum values, with standard deviations, chalcedony and Ch1 chert

The Watgal excavations represent a systematic attempt at recovery, analysis, and statistical treatment of all artefact categories, including complete and fragmentary examples, to enable the most comprehensive understanding possible of the Southern Neolithic cultural context. To date, neither the excavations nor the surface surveys have recovered any evidence, in the form of features or concentrations of any sort of debris, for the presence of a pre-Medieval workshop involving any category of non-perishable artefact at the site (albeit large areas have been removed by modern villagers). Other non-perishable artefact categories such as pottery and beads first appear in Occupation IIA and already reflect a technologically sophisticated level of craft development. Although these artefacts may have had a local or more regional source of origin, at present there is no evidence they were manufactured at Watgal. On the other hand, for the category of chipped stone-tools, the presence of exhausted cores, core rejuvenation flakes, debris, and broken tools over the entire site area, and throughout the cultural sequence clearly indicate that the final stages of manufacture, utilization and disposal were undertaken by the social groups occupying Watgal, although the stone used in manufacturing these chipped-stone tools may have been gathered locally and/or imported from a regional source. At this stage of analysis, it can be said that the lithic tools (milling stones, celts, and microliths), especially the chipped-stone examples discussed here, are the *only* non-perishable artefacts that were without question manufactured on site by social groups responsible for the occupations at Watgal. It is possible, therefore, that detectable changes among these chipped-stone tools, no matter how subtle they may be, may indicate other social factors affecting Watgal's inhabitants.

The present data indicate that Occupation I is clearly different from subsequent occupations, a situation observed long ago at other Southern Neolithic sites (e.g. Subbarao 1948). This difference is most clearly displayed in this study by a material profile showing the comparatively greater diversity of raw materials used, and the lower percentage of blades, blade cores, and lunates in the total chipped-stone assemblage. Because the number of these artefacts is so small, the addition of data from specimens from other excavation units might make it easier to compare the Occupation I artefacts to those of Occupation IIA. In any case, to completely characterize the chipped-stone from this assemblage, a detailed study and description of its flakes and flake tools is required. These artefacts will be discussed in a future study.

After Occupation I, the chipped-stone industry at Watgal centred around the production of blades, with this production exhibiting an increasing use of and reliance on *one* material: Ch1 Chert, the material most likely to have been imported or otherwise obtained off-site. Comparing the material profiles of all occupations, the total frequency of all blades and blade fragments rises sharply between Occupations I and IIA, increases again between Occupations IIA and IIB, then remains stable at about 45% of all chipped stone for Occupations IIB, III and IV. The relative frequency of Ch1 Chert blades and blade fragments in the assemblage of each occupation increases in the same way: sharply from Occupation I to Occupation IIA, less abruptly between Occupations IIA and IIB, and stabilizing at about 40% in Occupations IIB, III and IV. In contrast, Chalcedony blade production shows a clear peak in Occupation IIB, declining markedly in subsequent occupations. Increased blade production is mirrored by the increased presence of blade cores in the occupational sequence, and the blade cores also exhibit the intensified use of Ch1 Chert for these artefacts. This intensified use of Ch1 Chert in the production of everyday tools may reflect a technologically- and/or culturally-based preference as well as intensified and regular access to an off-site commodity.

Differences between the blade assemblages of various occupations can be seen in comparing the mean length and width measurements of unbroken blades. While Ch1 Chert blades are significantly longer than those of Chalcedony in Occupations IIA, IIB and III, they are not significantly longer in Occupation IV. Through time, the Ch1 Chert blades progressively shorten, but the differences in mean length are not statistically significant from occupation to occupation. In contrast, Chalcedony blades gradually lengthen beginning with Occupation IIA, but statistically the only significant change in mean length falls between Occupations IIB and III.

Variation is also clearly reflected in blade widths. After Occupation IIA, Ch1 Chert blades gradually become narrower, with a significant decrease between Occupations IIA and IIB. Similarly, Chalcedony blades gradually widen, with a significant increase between Occupations IIB and III. In Occupations IIA and IIB, Ch1 Chert blades are significantly wider than Chalcedony blades. However, by Occupations III and IV, the differences in mean width between Ch1 Chert and Chalcedony blades are no longer significant.

While the significant decrease in width of Ch1 Chert blades between Occupations IIA and IIB does not appear with other changes, the significant lengthening and widening of Chalcedony blades between Occupations IIB and III definitely coincides with the decrease in Chalcedony blades, both in raw numbers and in relative proportion within the assemblage. Whether these significant changes result from some as yet undefined change in the production technology used at Watgal, perhaps such as heat treatment, the introduction of metal punches, or some other cause, remains to be determined by further investigation of the blades and cores.

Ch1 Chert blade core lengths are significantly longer than those of Chalcedony in Occupations IIA, IIB, and III, and perhaps for Occupation IV as well. This may reflect a difference in the availability of sizeable pieces of these materials, as well as other factors which may affect procurement of an off-site commodity. Comparing the Chalcedony blade core mean lengths throughout these occupations, there appears to be some slight increase through time, although this does not test as significant between adjacent occupations. The same appears to be true for the Ch1 Chert blade core mean lengths. Tests comparing mean lengths for Occupation IIA to those of Occupation IV for both material subgroups may reveal statistically significant differences, but only at the potentially questionable 0.05 level. Perhaps cores in the later occupation were being discarded without being as extensively used ("exhausted") as they might have been in previous occupations. This shift in core disposal behaviour may reflect a shift in the cultural-technological value of chipped-stone tools at Watgal; or it may indicate that during Occupations III and IV the raw material, especially Ch1 Chert, was more accessible or more regularly available, thus countering the need to so completely "exhaust" a core. Clearly, however, the significant changes in blade length are not echoed by significant changes in blade core size.

It is possible that the changes in blade length and width definable in the Watgal sequence may reflect a trend toward standardization of product. That is, in earlier occupations the user of blades accepted that Chalcedony blades would be shorter and narrower than Ch1 Chert blades, whereas by Occupation IV, the user expected a blade of a certain length and width, no matter the material from which it was made. The intensification of use of Ch1 Chert through the sequence may also reflect this trend toward standardization, since a decrease in the variation of materials narrows the range of skills required by the artisan in order to shape the desired end product (Bradley and Giria 1996: 25-26).

This trend toward standardization in Occupations III and IV coincides with a substantial increase in the number of imported beads, the introduction of limited quantities of conch shell artefacts and metal objects, the appearance of wheelmade pottery (Jorwe and various Early Historic Period types), and the construction of at least one megalith (see also Sundara 1975). These factors suggest that the Watgal inhabitants of Occupations III and IV were being integrated into more complex systems of social, economic, and political relationships that may reflect the emergence of urban and state level organization in a broader regional context.

It is more difficult to interpret the changes in lunates in the occupational assemblages. While the percentage of lunates in any occupation peaks in Occupation IIA, there are also considerable numbers in Occupations IIB and III as well. The preferred material for lunates is clearly Ch1 Chert in all occupations, although lunates can be found in all other material types. Lunate lengths and widths do not seem to vary with material, in any occupation. The mean length of Ch1 Chert lunates increases through the Watgal sequence, and significantly so between Occupation IIB and Occupation III. The mean width of Ch1 Chert lunates decreases through the sequence, and significantly so between Occupation IIB and Occupation III (note that this is not correlated with the significant decrease in mean width of Ch1 Chert blades, which occurs between Occupation IIA and IIB). Hence, the changes in lunates are separate from, and independent of, the changes in the blades from which they were produced. Perhaps the changes in lunate dimensions may reflect a change in function: future study of microwear on lunates may shed some light on this question.

On a more general level, the independent changes delineated for blades and lunates may well suggest the cultural preferences and technological rules surrounding their production were different. The Watgal data do indicate that the production of microblades and microliths was a multidimensional cultural activity among Southern Neolithic social groups; that is, it involved more than just the categorical production of small chipped-stone tools. Previous studies based on descriptive typologies complemented by non-randomly collected data samples have failed to discern the potential cultural dynamics involved in Southern Neolithic microlithic technology.

Changes in material culture may occur almost imperceptibly in a traditional society. Throughout most of the span of habitation at Watgal (with the possible exception of Occupation I), the same materials and similar methods were used in manufacturing stone tools. However, some temporally- and socially- linked changes in the cultural templates from which the artefacts were patterned can be potentially identified by using quantitative methods. The cultural significance of these changes in material culture is considered here, but can only be fully explored when studying the site in its entirety, as will be done in the forthcoming evaluation of Watgal within the general Southern Neolithic context.

Acknowledgements:

Academically the authors are indebted to Professor D.K. Bhattacharya, Department of Anthropology, University of Delhi, whose critical observations of earlier drafts of this paper were most helpful. Dr. Brian G. Redmond, Mrs. Katharine C. Ruhl, and especially Dr. Frances B. King, of the Department of Archaeology, The Cleveland Museum of Natural History, also provided comments and advice. The authors assume total responsibility, however, for the analysis and interpretations presented here. The authors would also like to take this opportunity to thank the many people and institutions who have supported the Watgal research. Our first thought in this regard turns to the Archaeological Survey of India which gave permission for the team to work at the site. Additional permission and support came from the Karnataka State Directorate of Archaeology and Museums. Grants from the Smithsonian Institution Foreign Currency Program made it possible for the American team to join their Indian colleagues in this venture and we would personally like to thank Ms. Francine Berkowitz, Program Director, for her continued support of the Watgal project. Substantial administrative support and advice also came from the American Institute of Indian Studies and Dr. Pradeep R. Mehendiratta, the Institute's Director in New Delhi. Additional support for the lithic analysis was provided by The Cleveland Museum of Natural History.

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The Impact of Geomorpholigical Changes on Archaeological Sites: Isunuru, a Vanishing Megalithic Site on the Godavari River

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Abstract

Archaeological sites on the banks of nvers are subject to fluvial erosion, e.g. Megalithic Isunuru. The study of such sites can be used to understand the timing and occurence of episodes of enhanced fluvial activity. Fluvial dynamics responsible for the destruction at Isunuru include the development of a point-bar with lateral shifting of the river channel.

Introduction

Isunuru (17° 30' N; 81° 21' E), a tribal hamlet of Jidiguppa village in Vararamachandrapuram Mandal (Khammam District, Andhra Pradesh) is located on the left bank of the Godavari river (Fig. 1: 2). The area under discussion is part of the scheduled and reserved forest area of the Eastern Ghats inhabited by the Konda Reddys, a primitive tribal group.

Prehistoric studies in that area of the Eastern Ghats which is a part of the Godavari valley have resulted in the discovery of several archaeological sites (Yazdani 1927-28; Ahmed 1940-41; IAR 1984-85; Prakash 1986; Reddy 1996). The Isunuru megalithic site was identified in 1985 by the first author who noticed about 32 megalithic burials mostly dolmens with cairn packing. When the site was revisited in 1997 only 3 megaliths remained with the rest disturbed due to erosion between 1985 and 1997. The geomorphology and archaeology of what remained of the site were studied.

Geomorphic Analysis

The megalithic burials at Isunuru have been subjected to erosion due to the dynamic activity of the Godavari river which flows here in a west-east direction (Fig. 1: 2). The river has developed an escarpment bank to its left and an under-cut slope on its right side. The point-bar development took place due to sand accretion against its right bank which has led the water to flow towards its left bank, thereby eroding the escarpment bank. The erosion is not uniform all along the left bank but is intense at the megalithic site. The existence of a rocky ledge and the formation of a point-bar appear to be the causative factors for site erosion. The rocky ledge has subsequently been modified (due to erosion) into a channel island which has led the Godavari waters to flow even further left thus causing much erosion to the site. The point-bar formation led to the diversion of the water course which subsequently carved out a channel island. The point-bar and channel island cumulatively caused much erosion to the megalithic site which is on the escarpment bank. Figure 1: 3 is a schematic representation drawn to project the nature of destruction of the 3 extant megalithic monuments.

A cross profile of the Godavari at the Isunuru megalithic site has been drawn (Fig. 1: 4). from which it is clear that the escarpment bank is eroding, with the result that the megalithic boulders/slabs are being carried down into the Godavari up to a point where the channel island forms an obstruction. On either side of the channel island unpaired terraces, one with sand accretion and the other with silty sand deposition indicate periods of simultaneous lateral planation and rejuvenation (Spencer 1970). The point bar is acting as a slip-off slope whereas the escarpment bank has become an under-cut slope. This process has led to the destruction of the site. It is also clear that the megalithic site would have previously extended into the area between the outer edge of the escarpment bank and the channel island, when the channel island would have been the inner edge of the left bank of the Godavari.

Archaeological Analysis

Of the three extant burials, the one by the side of a gully and which is almost on the verge of erosion was been

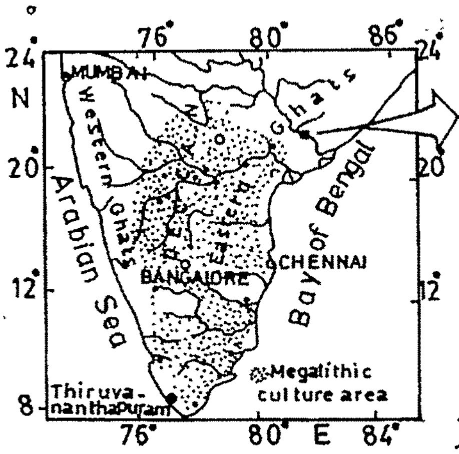

Fig.1·1 Megalithic culture area

INDEX
- □ SETTLEMENT
- ■ STONE SLABS
- ▣ EXCAVATED BURIAL
- ▬ UNDISTURBED BURIAL
- ▯ FOUNDATION STONE

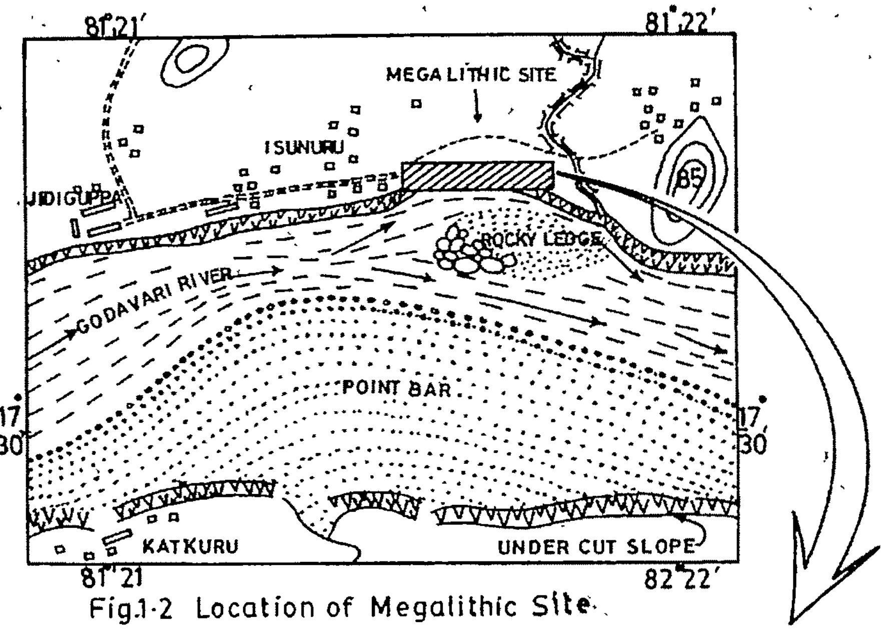

Fig.1·2 Location of Megalithic Site

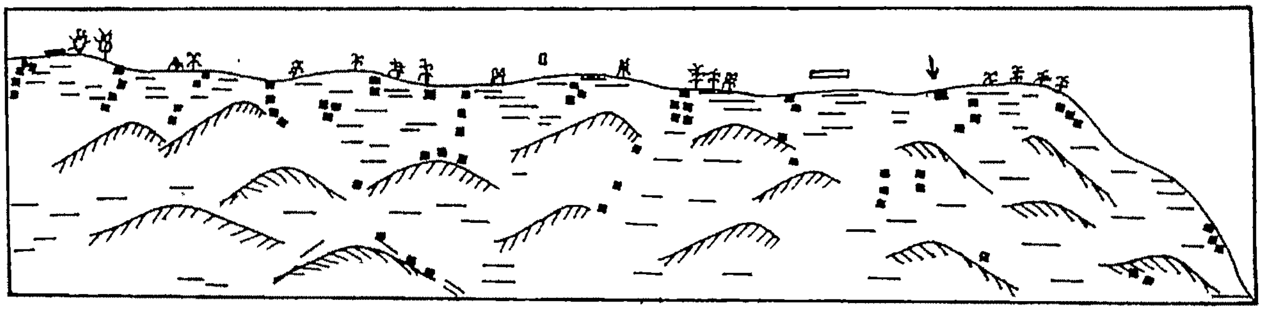

Fig.1·3 Schematic sketch of Megalithic site under erosion (Escarpment bank)

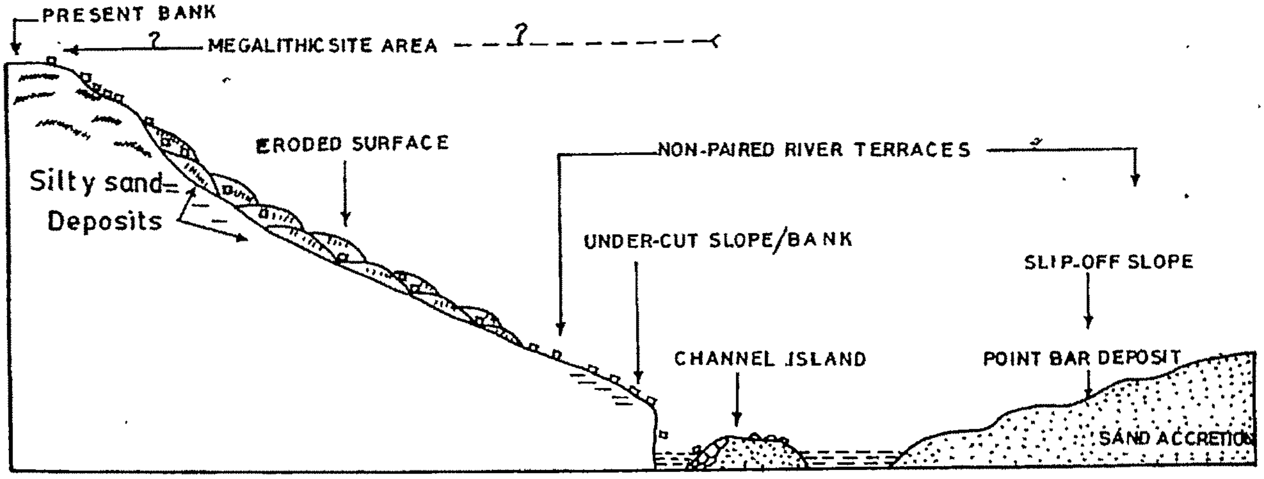

Fig. 1: Cross profile of river Godavari across Isunuru megalithic site

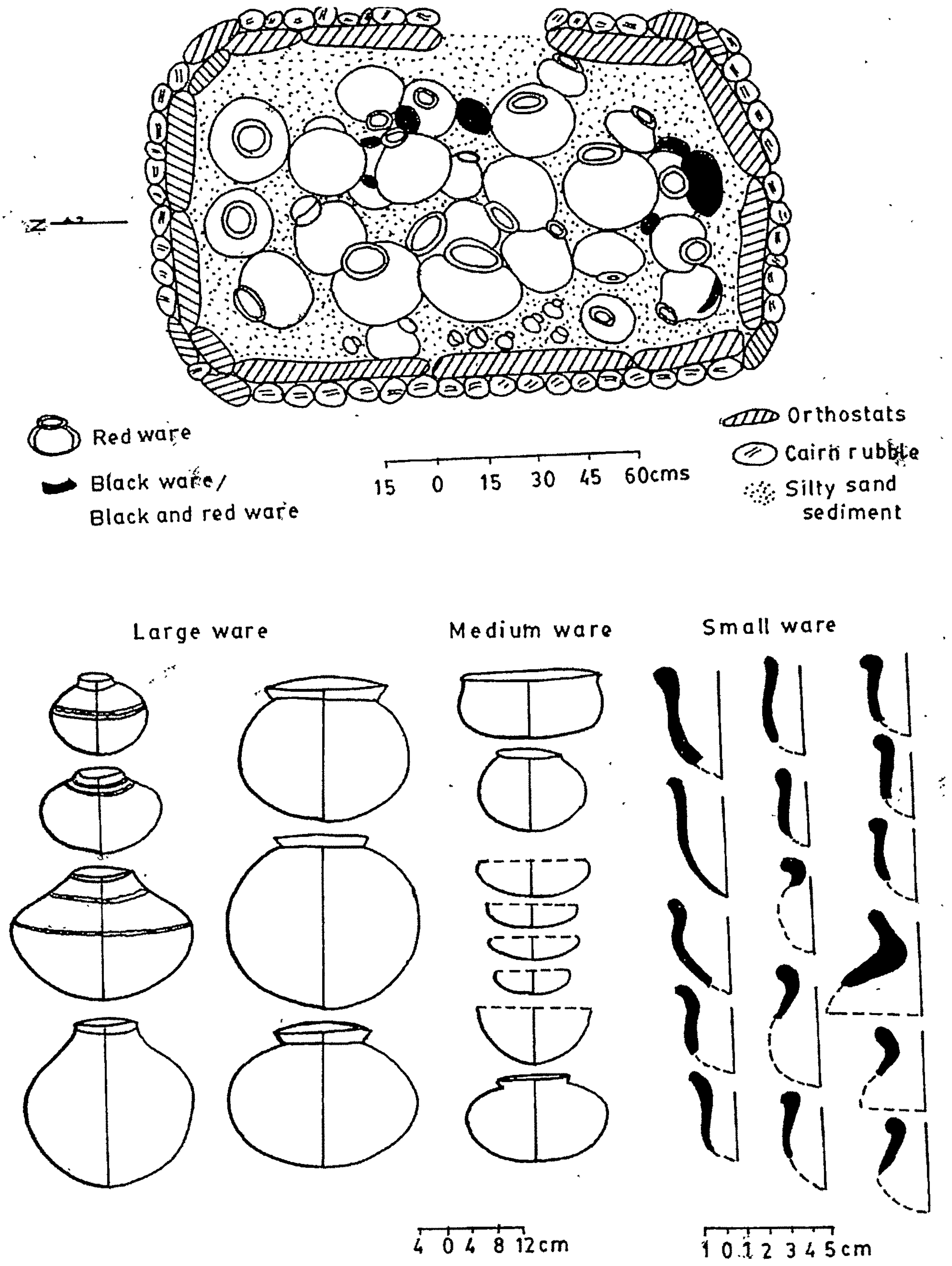

Fig. 2: Schematic representation of burial and pottery: size, shape and location

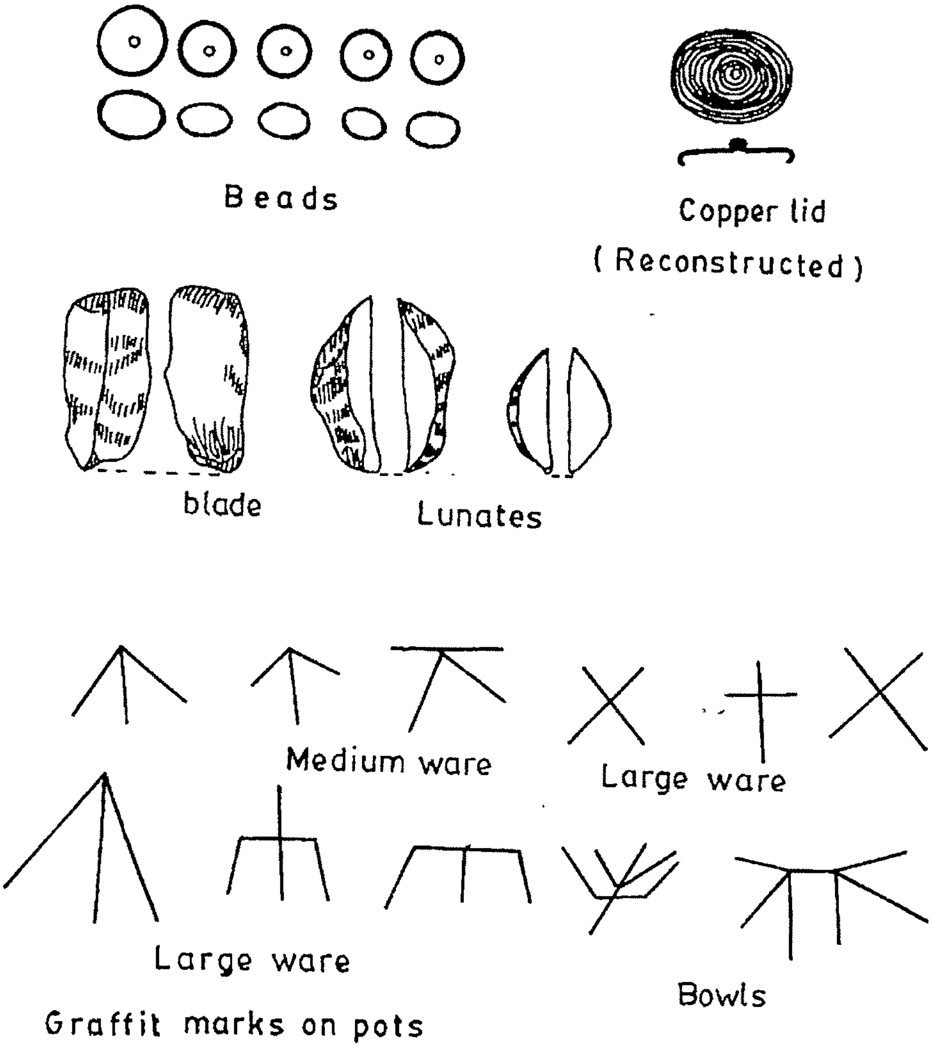

Fig. 3: Schematic representations of associated objects and grafiti marks

selected for excavation, to record the vanishing cultural material which might not survive another monsoon. Though not exhaustive, a careful excavation has resulted in the retrieval of pottery, copper objects, beads and osteological remains. In the vicinity of one of the eroded burials a blade and two lunates on chert were recovered (Fig. 3).

a) The Pre-Burial Process

The burial measures 1.8 m on the longer axis and 1.0 m on the shorter axis, and is oriented in a north-south direction, perpendicular to the flow of the Godavari river. The burial is a passage chamber covered by a capstone and supported by a number of orthostats (Fig. 2). There are three orthostats on either side and two each at both ends. They are mounted and the gaps in between them are packed with cairn rubble. The four corners of the chamber are further supported by elongated slabs mounted vertically. A narrow passage is provided on the eastern side of the burial.

The excavation has also helped us to understand the pre-burial processes A pit measuring 2.5 x 1.5 x 1.0 m was dug into the soil removing 3.75m^3 of earth (silty sandy soil). The pit floor was rammed (no floor slab is noticed), and subsequently the orthostats were put in place to make a stone box with a passage, which was then covered with a large capstone (1.8 x 0.80 x 0.25 m). The gaps in between the pit walls and the orthostats were filled with pebbles and boulders to form cairn packing. The upper surfaces of the orthostats were at ground level where the capstone was placed. The passage of the chamber is open and no cover has been provided. The raw material source was local and may be either the hill to the north of Isunuru which has quarried surfaces or the rocky ledge to the south of the site.

b) The Mortuary Process

The excavated passage chamber has yielded a wide range of pottery, beads, bones and a solitary copper lid. Inspite of the many limitations, an attempt has been made to understand the mortuary process by analysing the burial contents. A total of 53 pottery objects were found in the burial, out of which 41 are pots, and the remaining 12 are bowls (Fig. 2). All the pots are of Red Ware, are fresh, and have been further classified into large (15), medium (10) and small (16), while the bowls have been classified into Red Ware (2), Black Ware (2) and Black and Red Ware (8), based on their physical, textural and tonal contrasts.

The pots at either end of the chamber were placed individually in a single row, while at the centre there are two tiers of pots with the small pots placed over the large ones. The bowls find their place on a few pots as lids. The singly placed pots do not have any grave goods, but the large pots covered either with small pots or bowls contain bone pieces and beads. It could be inferred that the large pots were the ossuary while the others contained some offerings. The heterogeneity of non-ossuary pots (medium and small ware) suggests that they were meant for both solid and liquid food offerings.

Human bones are found only in pots, and comprise small pieces (ranging between 10 mm and 110 mm in length) with most of them belonging to the appendicular skeleton (74%) than to the axial skeleton (26%). The taphonomic analysis of bones is still in process in consultation with the forensic laboratory at Visakhapatnam. The presence of bone pieces only in the pots indicates that the burial is a secondary one.

Graffiti marks are seen only on a few pots (large and medium ware) and bowls, the presence of beads (9, 6 and 1 each in different pots) and a copper lid along with bone pieces in pots are other features (Fig. 3). Inspite of many limitations, it is inferred that the mortal remains (not the total corpse) were given an elaborate funerary treatment as indicated by the variety of grave goods (pots 41, bowls 12, beads 16, copper lid 1), and erection of a stone coffin.

c) Post-Burial Process

The burial was later subjected to alteration due to geomorphic events. The chamber including the pots were filled with fine sediments. Recent gullying on the western side has resulted in the outward inclination of the western orthostats and displacement and disfiguring of the pots in the western part of the chamber.

Since the burial is located on the river bank it has been subjected to submergence. In the years 1953, 1986 and 1994 the area was inundated by flood waters of the Godavari for about 3 to 5 days (information sought from Mandal office). The flood water sediments in suspension entered through the passage and slowly settled into the chamber without disturbing the burial structure and its contents. This process kept the burial intact until the escarpment bank developed. The gully erosion coupled with the weight of the capstone (0.36 m^3) probably resulted in post-burial disturbance. A similar process seems to be one of the causative factors for the site's destruction.

Discussion

Archaeological sites are subjected considerable transformation due to various economic (O' Brien and Lewarch 1981) and developmental activities (Allchin 1995). Megalithic sites are particularily vunerable as generally they are distributed over large areas in the vicinity of settlements or agricultural fields. Paddayya (1996) points out that their high visibility and the belief that they contain treasures makes them an obvious target for treasure seekers. Sometimes the rocks that were used for megalithic structures are quarried for construction activities.

The Isunuru megalithic site however, is endangered not due to human activities, but due to the natural dynamic process of the Godavari. The river by its nature often changes its course due to varied fluvial processes and at times new landforms are generated. In the present study area, the Godavari river started developing a point bar on its right bank opposite to the Isunuru site. The process of sand accretion has led to the diversion of river flow which in turn led to erosion of the escarpment bank where the megalithic site is located. The formation of a channel island between the point bar and escarpment bank has further stimulated erosion of the escarpment bank.

Destruction of an archaeological site, if due to human activity, can be checked either by the government or the public (Misra 1991; Paddayya 1996), but in this case such a check cannot rectify the damage as the destruction is by a natural force. In such cases, the best thing would be documentation and possible salvage excavation. Similar sites would also throw light on understanding the river geomorphology in a diachronic way. An inter-disciplinary study involving earth scientists and historians would throw more light on the role of archaeological sites in understanding the episodic geomorphic events.

In the Isunuru area the Godavari was probably flowing between the channel island and the outer edge of the point-bar. It is probable that the northern portion of the hillock on the left bank of the Godavari up to the present-day Isunuru settlement was occupied during the megalithic period. From our analysis it can be inferred that the Godavari river dynamics in terms of point-bar and channel island formation postdate the Megalithic period and the same dynamic processes were the causative factors in the destruction of the Isunuru megalithic site.

The main problem of understanding megalithic culture in India is the lack of known habitation sites. Several hundred megalithic sites are known from south India but most of them are grave sites with only a few habitation sites. In the present study area, a considerable number of megalithic sites are located along the Godavari valley north of Bhadrachalam (the site under discussion is 50 km south of Bhadrachalam). Each site is strewn with anything from 150-1500 burials (Yazdani 1927-28). Inspite of their density and extent, no habitation area has been found at any of the sites (Sastry 1983). However, a few megalithic habitation sites are known elsewhere (Wheeler 1948; Khan 1963; Gururaja Rao 1972; Subramanyam 1975; Sundara 1975; Narasimhaiah 1980; Ghosh 1986). These are generally located contiguous to waterbodies such as river courses, lakes, ponds and pools, while their grave yards are located a little away from the habitation towards the elevated part of the site.

The differential location of habitation and grave yard areas could be a factor leading to the greater destruction of habitational areas compared to grave yard areas. In the light of the present study, the greater vulnerability of habitation areas to fluvial modification could be a factor in the non preservation of megalithic habitation sites.

The Godavari valley area is known for frequent flooding of large areas so that the inhabitants have to be evacuated to safety. The post-flood operations in the valley mostly comprise repairs to the damaged houses. If this situation is taken as an analogy, the sheet erosion of flood waters and/or flash floods have destroyed the habitational sites, which are missing in the area today.

Acknowledgements

The present study is part of a UGC sponsored research project. The authors are grateful to Prof. K.T. Reddy, Dept. of Anthropology, Andhra University for his valuable suggestions, guidance and comments on the draft of this paper. They would also like to thank Dr. G. Paddaiah, Dept. of Anthropology, Andhra University, for his suggestions.

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Megaliths in the Upper Palar Basin, Tamil Nadu — a New Perspective

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Abstract

This paper is based on a systematic study of megalithic burials in the Upper Palar Basin (northern Tamil Nadu), as well as on recent theoretical and methodological approaches in field archaeology. Since both typological and chronological aspects of the megalithic culture have already been studied in detail, an attempt has been made here to look into other problems such as understanding the functional significance of the burial monuments in society, assuming that there is no need to erect huge stone monuments for the simple task of disposal of the dead. Ancient Tamil literature the early centuries of the Christian Era has been used as a tool to interpret the archaeological evidence.

Introduction

Sporadic archaeological investigations undertaken by the Archaeological Survey of India and other agencies in the Palar Basin in northern Tamil Nadu have shown a continuity of human cultures ranging from the Palaeolithic to the present (Narasimhaiah 1980). The author carried out a detailed and systematic study of the megalithic cultural phase in the upper reaches of the Palar Basin. The characteristic feature of the megalithic culture here is the presence of burial monuments which are either funerary or commemorative. Black and Red Ware, a distinct pottery fabric produced by the inverted firing technique, and iron implements are also associated with this cultural phase.

The Region

The study covers the Upper Palar Basin (600 km²) in the North Arcot-Ambedkar district which forms a part of northern Tamil Nadu (12° 45'-13° 00' N; 78°45'-79° 00'E), where the river Palar flows along with its tributaries, the Kaundinya and Agaram. These rivers are flanked by discontinuous gneissic rock formations. The region is generally characterised by the presence of hills, rivers, valleys, dense forests, dry and arid lands as well as agricultural and pastoral lands. The region falls within the dry sub-tropical zone with an annual rainfall of 800-1000 mm (Foote 1879; Cox 1881; Ramamurthy 1968).

Sources

Archaeological Data

This study is based on archaeological data which was collected during four seasons of field-work. This included systematic field walking covering more than 100 villages, trial diggings at a few sites and the collection of pottery and other cultural material. The field survey has brought to light 19 megalithic burial sites and 18 habitation sites, yielding Black and Red Ware, of which a few sites had been discovered prior to the present study by K. Kumar (personal communication) and K. Rajan (1991-92).

The survey conducted in the Upper Palar Basin has revealed two kinds of burial sites: dolmens and stone circles (Fig. 1). The former, a table-like structure is made-up of four slabs with one of them acting as a top slab and the other three as side orthostats. The dolmens are not sunk into the ground and as such do not have any funerary remains. They serve as memorial or commemorative structures. In the Upper Palar region, dolmens are found on hill tops on the rocky terrain. The stone circle marks an area where a burial has taken place and huge stone boulders are arranged in a circle. They are in some cases, covered with cairn packs and they usually contain either a cist (a chamber-like structure made out of four granite slabs with an opening in the eastern orthostat) or a

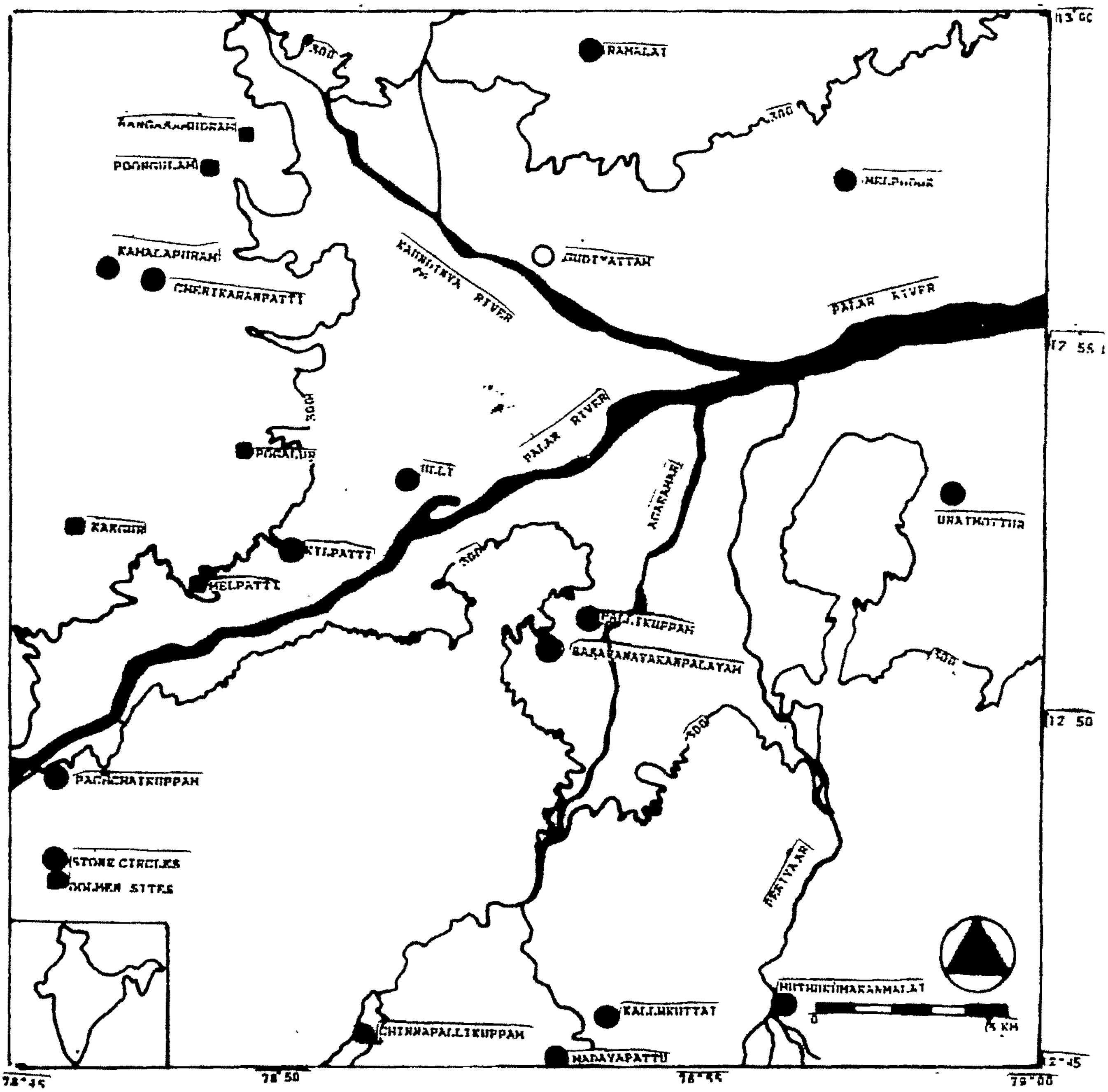

Fig. 1: Archaeological sites in the Upper Palar Basin, Tamil Nadu

sarcophagues (a terracotta container for human remains). In the Upper Palar Basin, the stone circles are situated in the foothill areas.

List of burial sites

Site	Nature of Burials	Number of Burials
Rangasamudram	Dolmen	20
Poongulam	Dolmen	20
Melpatti	Dolmen	3
Pogalur	Dolmen	14
Kargur	Dolmen	30
Kamalapuram	Stone Circle	10
Cherikaranpatti	Stone Circle	30
Kilpatti	Stone Circle	3
Ulli	Stone Circle	15
Pachchaikuppam	Stone Circle	10-15
Ramalai	Stone Circle	20
Melpudur	Stone Circle	8
Pallikuppam	Stone Circle	3
Basavanaykan	Stone Circle	4
Muthukumaranmalai	Stone Circle	30
Kallukuttai	Stone Circle	3
Madaiyapattu	Stone Circle	#
Chinnapallikuppam	Stone Circle	6

# not known due to the disturbed nature of the site

The megalithic culture of the Upper Palar Basin may be dated between 300 B.C. and A.D. 300 on the basis of radiocarbon dates available for megalithic sites such as Paiyampalli and Appukal (Possehl 1993) and also taking into account the chronology of the *Cankam*[1] literature.

Literary Data

The ancient Tamil literary sources known as the *Cankam* classics and dated to the early centuries of the Christian Era have been extensively studied and used here as a conceptual aid for the interpretion of the archaeological data. The *Cankam* literature is a collection of Tamil poems belonging to the Tamil Academy and has been dated between 300 B.C and 300 A.D. The major works of this literary academy are *Tolkappiyam* (an ancient Tamil grammar), *Ettutokai* (eight anthologies), and *Pattupattu* (ten idylls).

Unlike other works, the *Cankam* literature deals with the day-to-day activites of the common people against the background of the natural landscape. The ancient Tamils divided the landscape into five divisions called *Ainthinai*, which form the basic theme of all the *Cankam* poems. This five-fold division comprises: *Kurinci*, (the mountainous zone), *Mullai* (the pastoral zone), *Marutam* (the riverine zone), *Neytal* (the coastal zone), and *Palai* (the arid zone). In relation to these, each *tinai* has its own characteristic time, season, fauna, flora, birds, occupation and human population and love situation (Ramanujan 1967). The subsistence of the people residing in these five divisions differs according to the ecological conditions, hunting and gathering in the *Kurinci*, animal husbandry and minor cultivation in the *Mullai*, agricultural activities in the *Marutam*, fishing in the *Neytal* and cattle lifting and plundering in the *Palai*. Based on the criteria enunciated in ancient Tamil literature, the Upper Palar Basin has been divided into different ecozones and their characteristic features identified.

The dolmens are found in the hilly region which is thickly vegetated with thorny shrubs like cactus. There are natural springs (*sunai*) near the dolmen complexes. Close to these dolmen clusters there is rich pasture land which is used by the present- day pastoralists, otherwise the area is dry and arid. Based on these physical features, we can ascribe this region to the *Mullai* and the *Palai* ecozones of the ancient Tamil literature. This is the reason why the dolmens, although they occur in the hilly area, have not been assigned to the *Kurinci* (hilly zone).

The stone circle sites in the region under study are situated in the foothills nearer to water sources where the vegetation is thick, and in some places pastoral land was noticed. In a few other areas, stone circles were also found in the agricultural zone. We can therefore ascribe this region to the *Mullai* and *Marutam* ecozones.

Interpretation

The typological and chronological dimensions of the megalithic culture have already been studied by several scholars: Krishnswami (1949), Gururaja Rao (1972), Leshnik (1974), Sundara (1975), Narasimhaiah (1980) and others. The author therefore decided to tackle other problems such as understanding the role of the Megalithic monuments in different societies, and in this context sought help from the theoretical and methodological strategies currently being used in European archaeology (Renfrew 1994; Thomas 1993; Tilley 1994). These perspectives have been used to study and understand different aspects of burial monuments, e.g. the social organization of the megalith builders, the functional role played by the burial monuments, and their visual and symbolic significance.

Social Organization

An attempt has been made to study the social organization of the megalith builders in the Upper Palar Basin based on the work of previous scholars who sought to use burial monuments to reconstruct the social structure of past societies (Kinnes 1975; Renfrew 1984 and 1981; Sjogren 1985), as well as on the accounts of the *Cankam* literature which mentions the social structure of the ancient Tamil country.

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[1] *Cankam* is the ancient Tamil version of the Sanskrit *Sangam*

Archaeological Evidence

As mentioned earlier the dolmens are situated only on the hill tops in a linear alignment (Fig. 2). There is no uniformity in either the geographical zones of these burials or in the geographical features associated with them. Natural resources like pasture, water sources are widely scattered. The ecological zone of the dolmens are the semi-arid, hilly plains and the pastoral land. The stone circles are found in the foothill region mainly in the agricultural regions. These burials are clustered and concentrated at a particular point (Fig. 3) near natural resources such as water and fertile land.

Based on the study of monuments in Sweden, Sjogren (1985) created a logical relationship between socio-economic patterns and burial practices. He further categorised the burial group into 'irregular' and 'regular' patterns[2]. He argued that the 'irregular' patterns indicate the presence of segmentary groups with territorial subsistence strategies but without a defined territory or having a separate territory but less densely populated and with an irregular geographic background. On the other hand, the 'regular' patterns possibly indicate the presence of the kinship/descent- based groups who have a hierarchical structure with a defined territory, a definite resource area and greater population density.

Literary Evidence

Among the five-fold landscape divisions, only the *Mullai* and the *Marutam* have been considered here for the study of the social organization. It should be noted that there is no definite social system prevalent in the semi-arid Palai zone, as the region is only "formed" when the pastoral and the hilly regions become parched in summer. Consequently, only the social structure of the pastoral zone has been studied since, though even minimally, it provides the crucial natural resources such as pasture to the people of both the *Palai* and *Mullai* landscapes.

For the population in the *Mullai* landscape, the main economic activity is animal husbandry and in course of time due to interaction with the people in the *Marutam* landscape, cultivation has been adopted, albeit to a minor degree. Since the pastoral activity in this region is not nomadic as known from the *Cankam* sources (Sivathamby 1968; Zvelebil 1975), scholars believed the social organi-

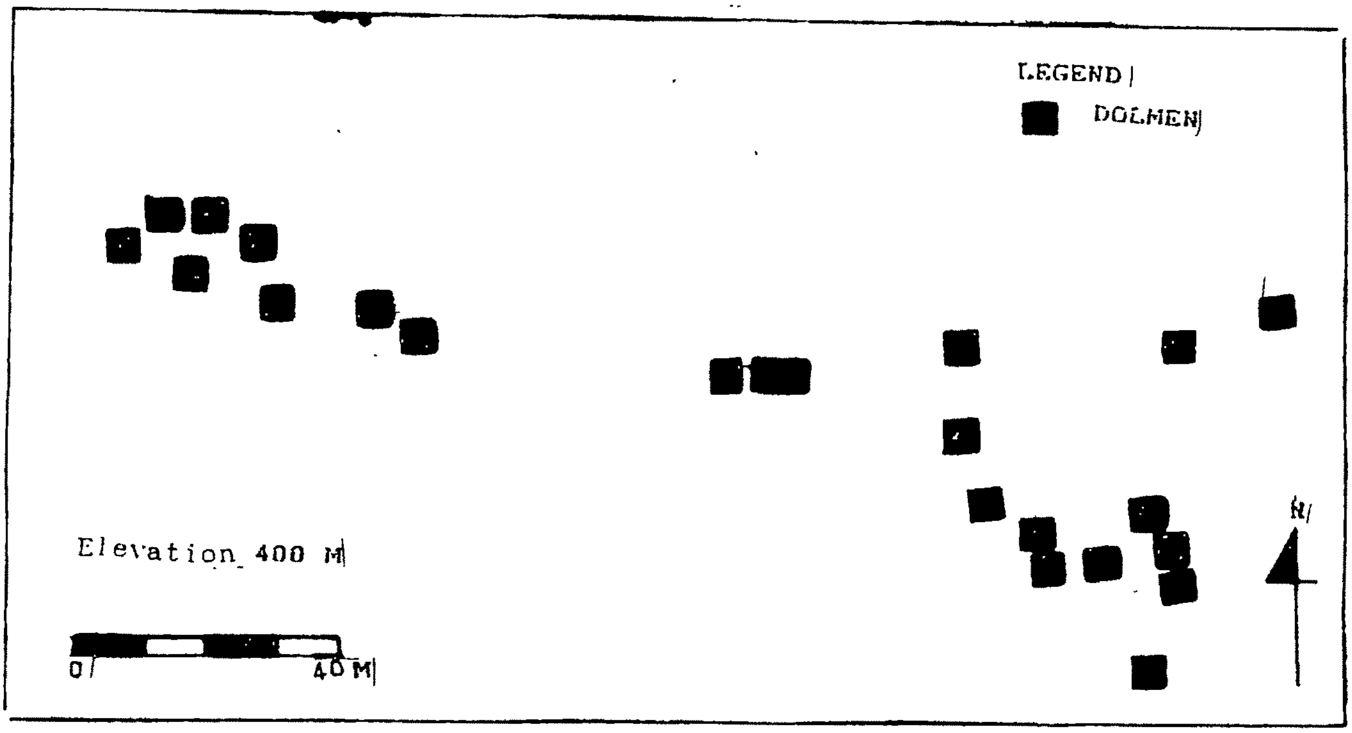

Fig. 2: Distribution of dolmens at Kargur

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[2] A regular pattern indicates a region where the necessary natural resources are available in clusters, whereas in the irregular pattern critical natural resources are not available throughout the year and are dispersed

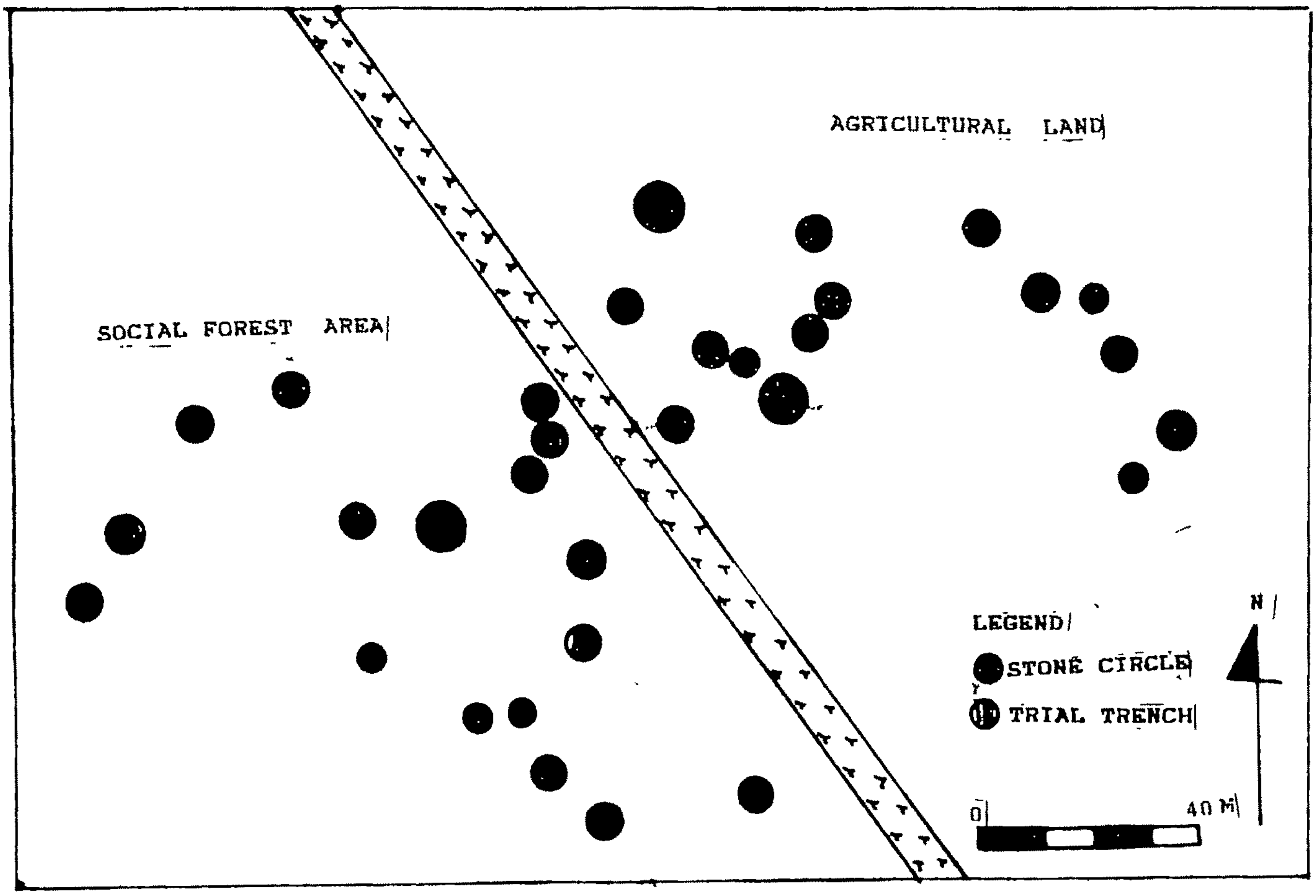

Fig. 3: Distribution of megaliths at Cherikaranpatti

zation to be tribal in nature (Sivathamby 1968). The reference to *Kuti* in Tamil literature "seems to have been associated with the primary economic base, i.e. the herd, and its affiliated social group, i.e. the extended family" (Seneviratne 1981: 56).

In the case of the *Marutam* landscape, the main economic activity is agriculture. References in the *Cankam* literature to the presence of chiefdoms in the riverine and agricultural zones has prompted many scholars to assign to this zone a hierarchy-based social structure. In the agricultural tracts, both the ownership of land, and the presence of a specialized labour force such as goldsmiths, coppersmiths, salt merchants, and potters gave rise to an aristocracy. The redistribution of resources in the form of *Kotai* to the poets and nomadic bards was also taken as evidence of the rise of a hierarchy-based chiefdom (Hart 1974; Narayanan 1988; Gurukkal 1987; 1989; Seneviratne 1993). It should be noted that only in the agricultural zone was the institution of state (*Natu*) developed.

Based on the archaeological and literary evidence the author has drawn certain inferences regarding the social structure of the builders of the dolmens and the stone circles. The former situated in the *Mullai* and the *Palai* are characterised by scattered crucial resources such as pasture, water sources and within have an 'irregular' geographic pattern (*Vanpulam*). This could probably be taken to mean that the builders of the dolmens formed a loosely knit, small-scale segmented society (*Kiti*) (Fig. 4). On the other hand, the stone circles occur in *Marutam* with clustered and abundant natural resources such as fertile land and a'regular' geographic background (*Menpulam*), suggesting that probably the builders of the stone circles formed part of the regular pattern of a large-scale hierarchy-based chiefdom (*Natu*) (Fig. 5).

Dolmens as Territorial Markers

The primary purpose of the burial monuments is no doubt the disposal of the dead. However, as there is no need to erect huge monuments for the simple task of disposing of the dead, several European archaeologists (Fleming 1973; Wood 1978; Darvill 1979; Renfrew 1984, 1981; Vyner 1994; Chapman 1995) have argued that these monuments

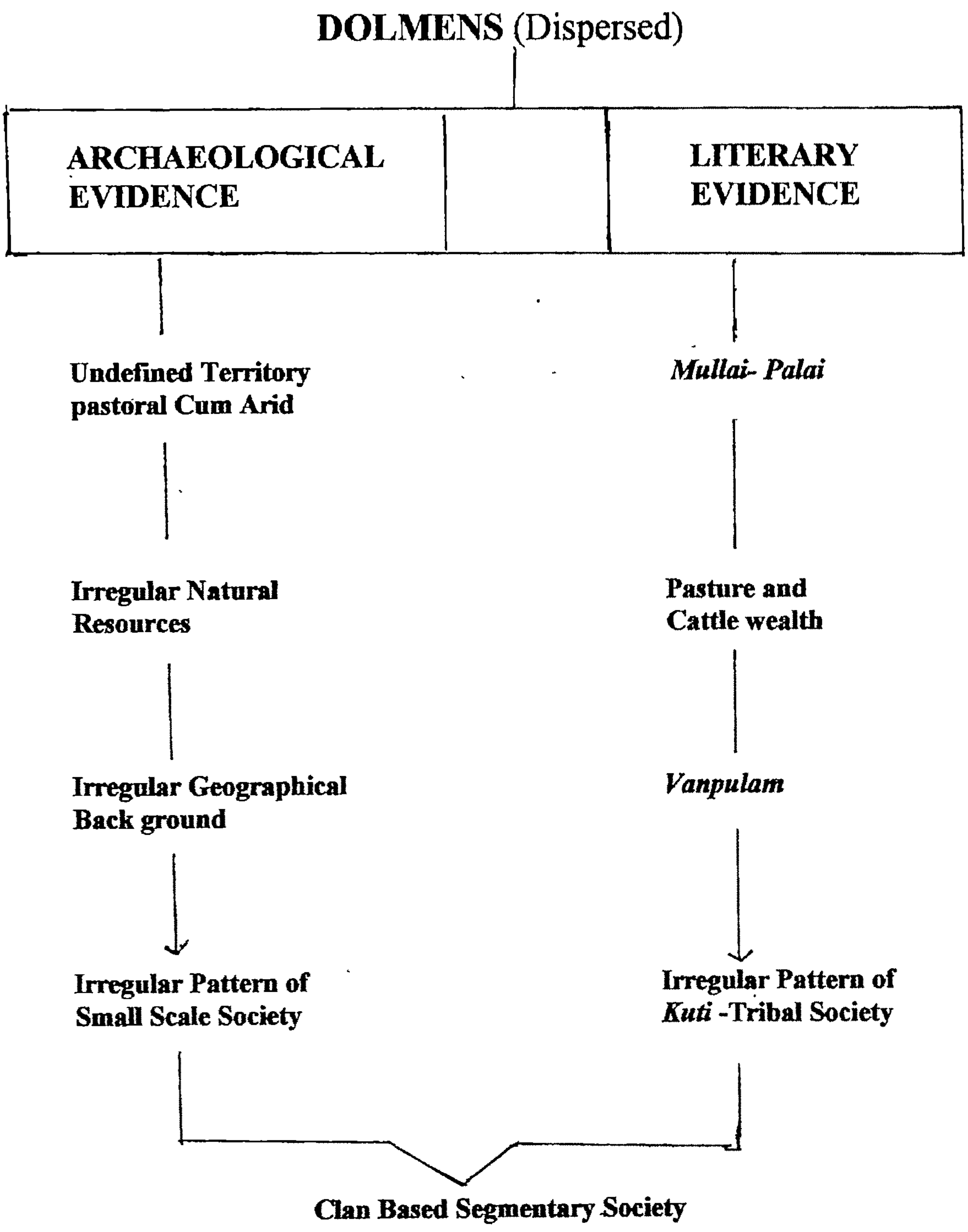
DOLMENS (Dispersed)
ARCHAEOLOGICAL EVIDENCE
LITERARY EVIDENCE
Undefined Territory pastoral Cum Arid
Mullai- Palai
Irregular Natural Resources
Pasture and Cattle wealth
Irregular Geographical Back ground
Vanpulam
Irregular Pattern of Small Scale Society
Irregular Pattern of Kuti -Tribal Society
Clan Based Segmentary Society

Fig. 4: Clan-based social organization (modified after Sjogern 1985)

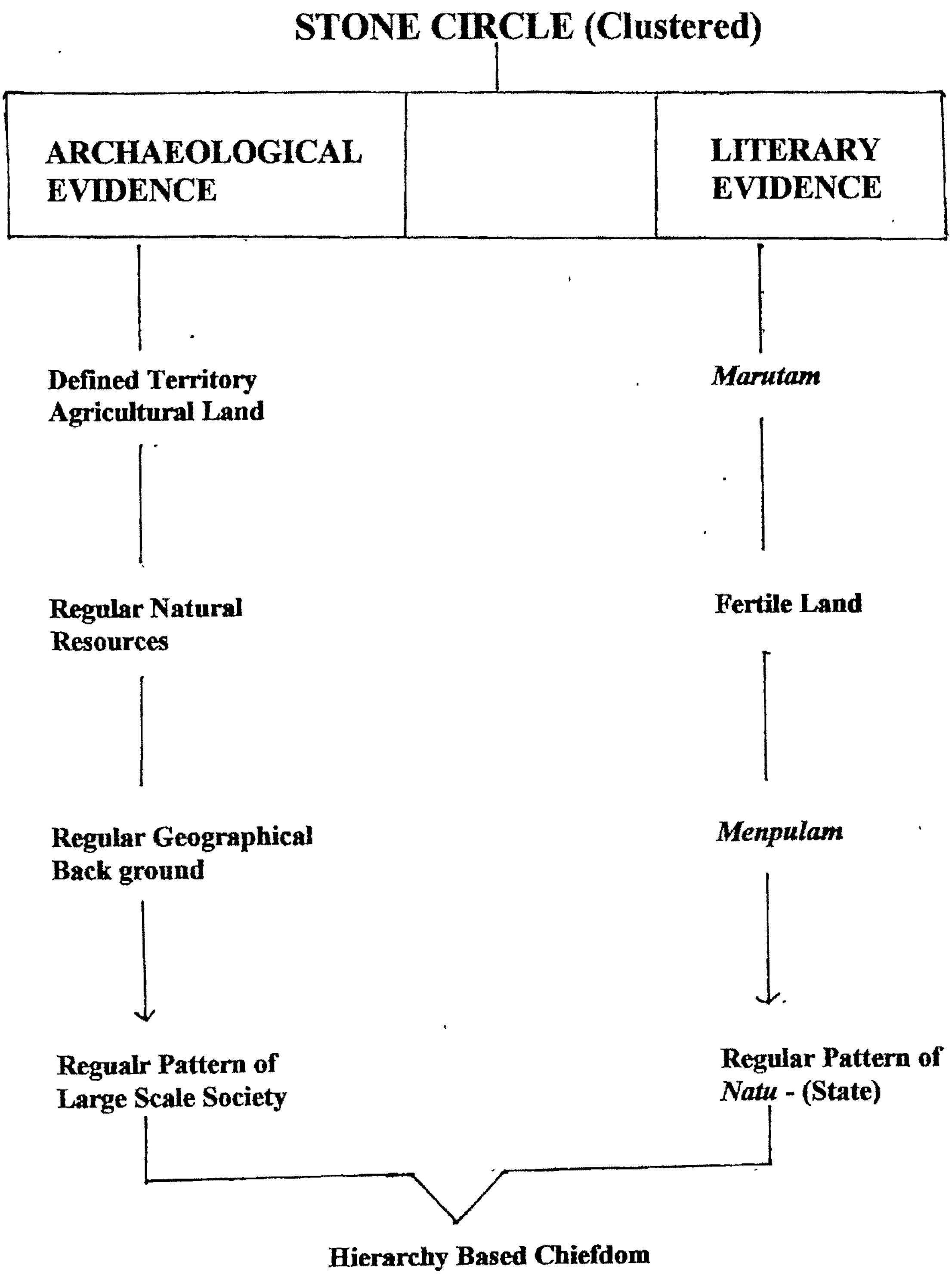
STONE CIRCLE (Clustered)
ARCHAEOLOGICAL EVIDENCE
LITERARY EVIDENCE
Defined Territory Agricultural Land
Marutam
Regular Natural Resources
Fertile Land
Regular Geographical Back ground
Menpulam
Regualr Pattern of Large Scale Society
Regular Pattern of Natu - (State)
Hierarchy Based Chiefdom

Fig. 5: Hierarchy-based social organization (modified after Sjogern 1985)

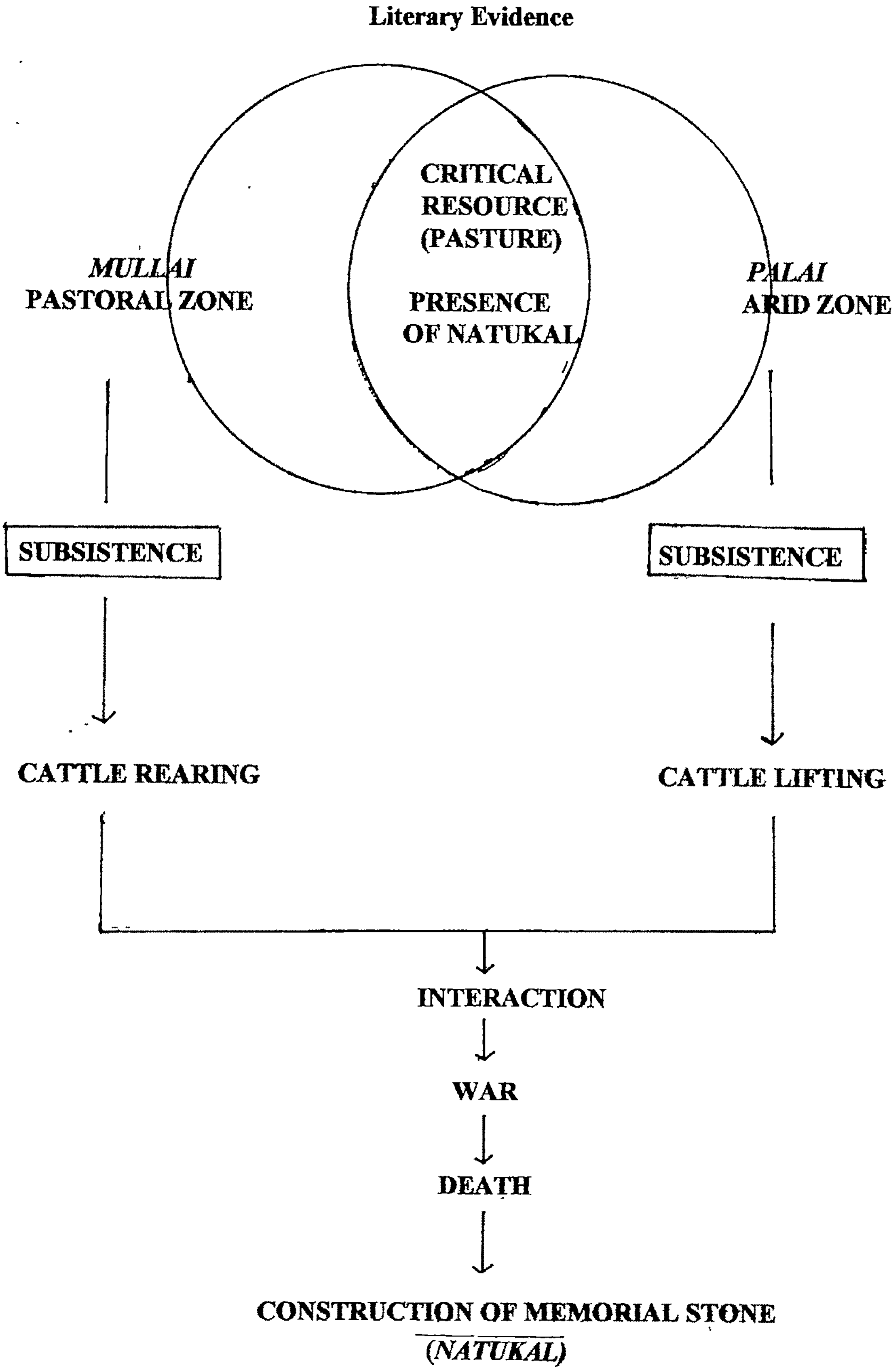

Fig. 6: Dolmens as territorial markers

acted as territorial markers of the segmentary groups. Territorial behaviour is a common trait among human and animal populations for whom there is a strong need to mark an area which is important to a particular society. The monuments have been considered as markers to proclaim people's right over critical resource areas.

Using a previously described functional model (Renfrew 1984, 1991) the dolmens in a particular zone (arid and pastoral landscape) in the Upper Palar Basin have been interpreted as territorial markers of the segmentary group. The dolmens in the study area are memorial in nature. They do not contain any skeletal remains and grave goods.

Literary Evidence

In order to verify this hypothesis two ecozones — the *Palai* and *Mullai* — were analyzed in detail since dolmens are found in both these ecozones.

The *Palai* landscape is characteristically an arid and dry area. The terrain is difficult to traverse and this rough and uninviting landscape is strewn with boulders and with wild and dangerous pathways (Sambamurthy 1968). The inhabitants of this region, true to the nature of the landscape lead a rough and dangerous life, and since the land available for agriculture is limited, the people resort to robbery and cattle lifting. Thus the picture of the *Palai* landscape reveals an "area with the stressed attributes of fear, danger and death" (Dubiansky 1979: 94).

Animal husbandry and minor cultivation are the main occupations in the *Mullai* landscape. As compared to the lifestyle of the *Palai* dwellers, the lifestyle in the *Mullai* zone is peaceful and struggle-free (Zvelebi 1975). However, the people of the pastoral land are always on their guard to protect their resources, mainly cattle and pasture, from attacks by their hostile neighbours.

The cattle and pastoral wealth of the *Mullai* draws the attention of the *Palai* as they live close to them. "... the fierce cattle raiders, often consisting of bands residing in the dry desert lands near the fertile plains and forest areas of the cowherds, organized plundering expedition to carry off large number of milch cows and bulls" (Narayanan 1977: 73). There are references to the lifting of cattle from the *Mullai* by the people of the *Palai*. These raids led to violent situations which culminated in the death of many warriors for whom numerous stone burials, known as *Natukals*, were erected in the forest tract (Arunachalam 1968; Nagaswamy 1974; Soundara Rajan 1982). These monuments were constructed in the hilly and thickly vegetated forest area which is strewn with boulders.

Scholars differ in their interpretation of these memorial monuments. Quoting an example of a song from *Narrinai* in which a bard while directing another minstrel, describes the path which is "... replete with *katu* and forked pathways, full of *karrali* and stones planted in memory of warriors who died a heroic death...". Srinivasan stated that the burial monuments could have looked like a dolmen (Srinivasan 1958-59:7). Scholars have agreed to with this view and arrived at the conclusion that the *natukals* mentioned in the *Cankam* literature were possibly the dolmens of the megalithic period (Raman 1974; Rajan 1992) (Fig. 6).

Based on the archaeological and literary evidence it may be suggested that the dolmens in the Upper Palar Basin acted as territorial markers. The location of the dolmens within the pastoral zone combined with the *Cankam* literature's description of the construction of stone monuments for those who died while protecting their cattle from the "aggressors along the pathway" and in places where they attract attention are the two main criteria for considering the dolmens as territorial markers.

Apart from fulfilling their primary functions, these monuments served to mark and control critical resources — pasture land and cattle wealth. A need to protect their resources must have been strongly felt by the descent-based segmented society. The reference in the *Cankam* literature to the worship of the *natukals* by the people of the pastoral-cum-forest tract (*Purananuru* 335; Chelliah 1946) could have been taken as an indication of the fact that the stone monuments were constructed by the people of the pastoral land. References in Tamil literature to the linear placement of these memorial structures along the forest tract could be taken as support for the hypothesis that the people of the pastoral-cum-woodland whose subsistence centred around the mobile herd, and who were living close to aggressive neighbours, could have marked their territory thus to assert their right over these resources and thus safeguard them.

Visual Significance of the Burials and the Landscape

Apart from studying the functional aspects of burial monuments, archaeologists (Evans 1985; Thomas 1993; Tilley 1994, 1996a, 1996b). have also studied their significance in relation to the landscape in which they occur.

The mere fact that the megalithic monuments are constructed of durable materials indicates that they are built to be seen not only by the people of the concerned period but also by future generations. The building of these monuments at certain strategic places and the spatial arrangement of the burials in relation to the terrain give some visual meaning to these monuments and to the landscape itself. Archaeologists in Europe have followed various methods to study the visual significance of the monuments assuming that the burials signify certain elements of the culture. They have used the visibility

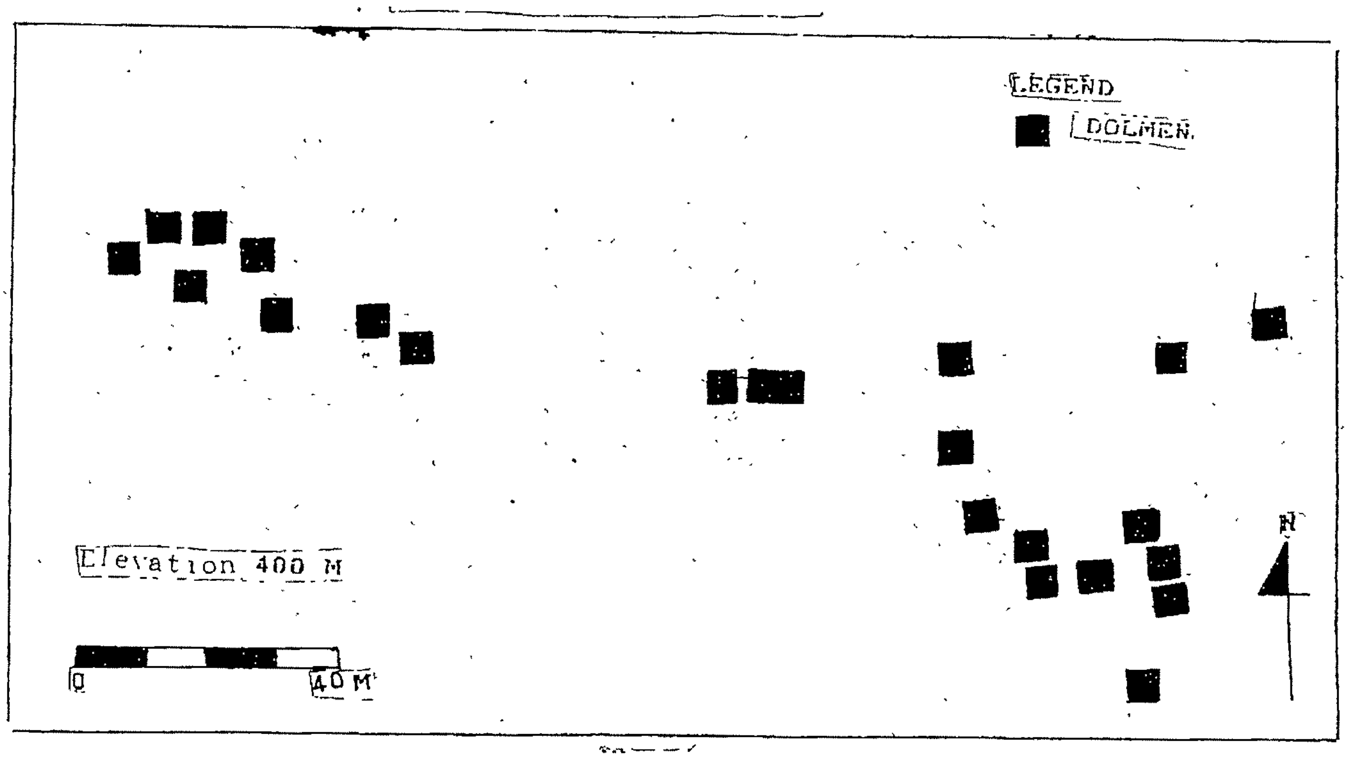

Fig. 7: Site map of Rangasamudram

(intersite and intrasite), and the location of the monuments in a given landscape, local legends, ancestral association of sites, etc. as the main criteria (Cooney 1990; Criado Boado *et al.* 1994; Tilley 1994). In the same way, the megalithic tombs were seen as symbolic indicators of the past society. It was argued (Thomas 1990, 1993) that monuments containing the remains of ancestors with symbolic values attached to them, influenced the perception and interpretation of the contemporary community. For this purpose, local legends associated with the sites have been used to understand the significance of the landscape.

The burial sites in the Upper Palar Basin have been mapped from the perspective of visibility and an analysis of the visual and symbolic significance of the monuments is attempted here.

Dolmens

The relationships of the burials with one another from the visibility perspective was mapped at Rangasamudram (one of the dolmen sites) and revealed a linear pattern (Fig. 7). Next, the prominent visibility points were drawn from the strategic locations (Fig. 8) — in this case the pastoral land and the pathway. In the hilly tracts there are no definite pathways and today people find their way between rocky boulders and use these paths for the movement of grazing animals. A similar picture might also have existed in the past. From this site, another dolmen site, Poongulam can be seen. The other prominent hills which contain either rock paintings or habitation sites in the foothills can also be noticed (Erthangal hill, Chennarayanapalli hill). Thus the location of the dolmens at elevated points enables one to have a good view of them and it appears that the dolmens were constructed mainly to convey the presence of the past.

Local Legends

The location of monuments at significant points on the terrain, either enhances the features of the landscape features or subdues them. In this connection, the author has made use of the local legends associated with the important natural features seen in the study area to demonstrate the significance of the terrain. Most of the sites are associated with the legend of the five Pandava brothers, the heroes of the *Mahabharata.* As noted at Rangasamudram, prominent rocky boulders, natural springs, etc. have local legends attached to them. For example, the *etuttu vaita kuntu* (which literally means 'a rock which was kept') which can be seen prominently even from a distance (from the foothill area), is associated with the legend that the mother of the Pandava brothers used a small stone to pound betel nuts, and when she put it down on the ground, it started growing and growing till it assumed its present form. The *tunkara kuttai* (which literally means 'sleeping boulder') is the place, according to local legend, where one of the Pandava brothers is said to have taken rest after a tiring day

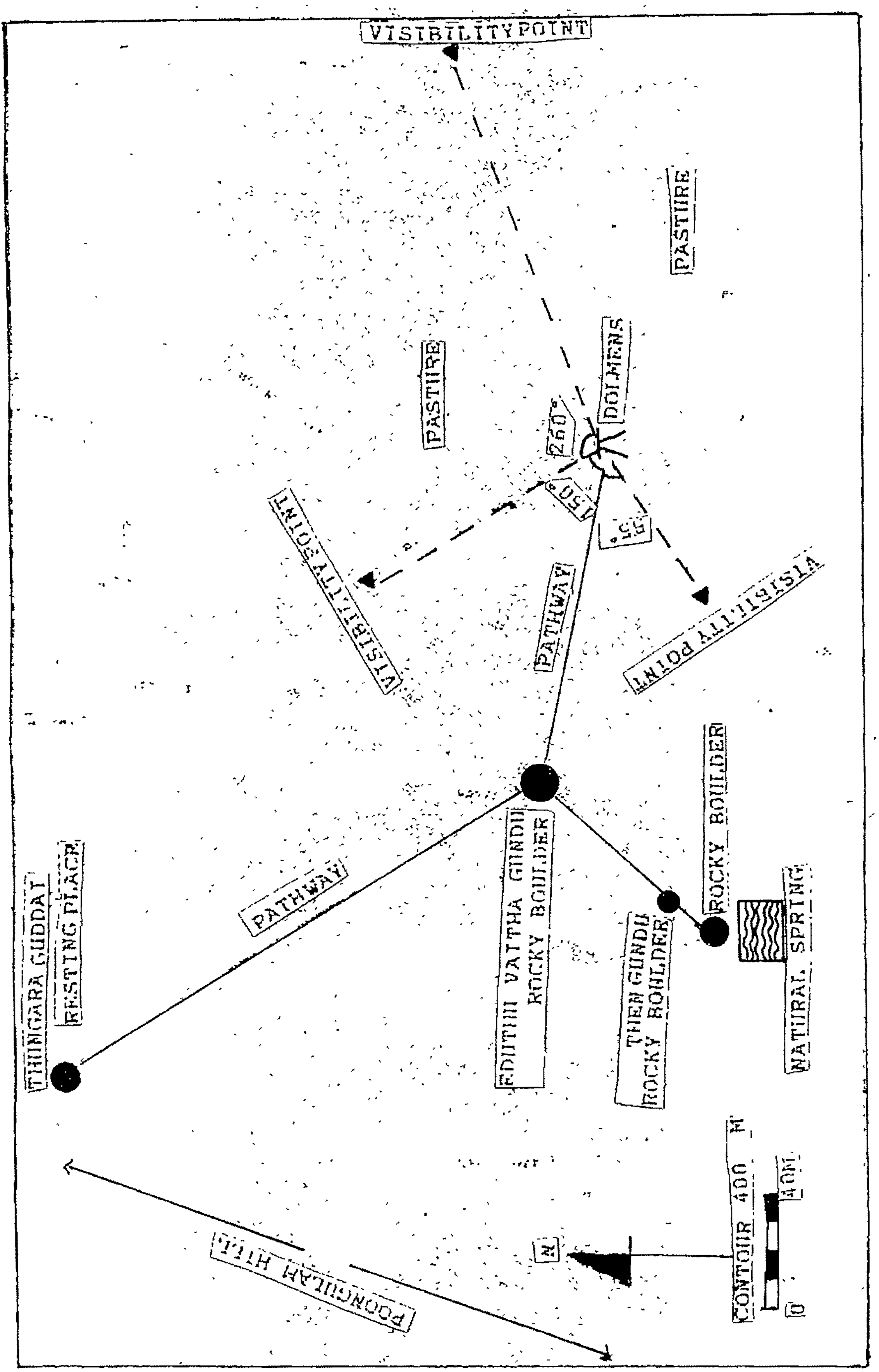

Fig. 8: Important natural features and visibility points at Rangasamudram

The natural springs are also considered to have been created and used by the family of the Pandavas. Interestingly the burial monuments in the area of study are, according to the local villagers, the dwelling places of the Pandavas who lived here during the time of their exile. As one moves around these rocky boulders, one finds that all the places which are significant from the perspective of local legend, invariably lead to the location of a dolmen complex. All these features in the landscape act as reference points for the dolmens which are located at places which are marked by significant landscape features such as boulders, natural springs or pastures, and are further associated by the local populations with these legendary ancestors.

Literary Evidence

Based on the literary accounts, it can be inferred that the landscape occupied by the dolmens constitutes the dry pastoral area where human activity revolves around the pathways and the pasture land for subsistence (both for the people of the *Mullai* and the *Palai*). There are also references in the *Cankam* literature where a bard directing another poet indicates the location of the burial monument as a reference point to guide the latter's movement in the rough terrain (*Mȧlaipatukatam*).

Thus the dolmens are situated at significant points in the landscape enhancing their visibility and making them focal points along pathways. This seems to indicate that they might have acted as symbolic reference points loaded with ancestral meaning, to guide the movement of human and animal populations from one significant point and site to another.

Stone Circles

The stone circles occur in clusters in the foothill areas and unlike dolmens they are not sited near significant places. The relationship of the burials with one another when mapped (Fig. 3) showed that there are no outstanding natural features which could have determined the location of the monuments. Only the burials stand out as significant points and enhance the natural features. The stone circles, which attract the attention of viewers, enhance the natural features like small *nalas* and natural springs. In other words, here the monuments enhance the significance of the landscape features and, "landscape was understood in terms of its relationship to the siting of the monuments" (Tilley 1994: 203)

By building enduring monuments for the dead, ancient peoples maintained a relationship with the dead. The stone circles, as against the dolmens which are constructed above the ground, contain the remains of the dead in pyriform jars or in sarcophagii which are sunk into the ground. The dead were buried along with elaborate grave goods. The trial trench taken at the stone circle at Cherikaranpatti revealed nearly twenty pots, neatly placed on the northern side of the burial. In some places there is evidence for burial of human bones. In the absence of any significant landscape features, the remains of dead ancestors are given importance in order to maintain the links of the living with their ancestors.

The author's research is an attempt to study certain aspects of the archaeological data from Upper Palar Basin that have been hitherto neglected. The models presented here are essentially for the megalithic burials of this region, however, they can also be extended to other sites yielding similar archaeological evidence.

Acknowledgments

The author wishes to express her gratitude to her research guide Prof. K. Paddayya, to all her friends for their valuable help, and to the University Grants Commission, New Delhi, for financial support.

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Further Excavations at Kodumanal, Tamil Nadu

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Abstract

The fifth season of the excavations at Kodumanal yielded additional data on the megalithic graves. The cairn circle entombing a transepted cist with a subsidiary cist on the east yielded some interesting grave goods which were not found in the earlier excavations. For the first time a deer burial along with a pot containing etched carnelian beads, a sword and axes was found. The purpose and nature of the porthole are further clarified in this excavation. The graffiti marks on the grave goods conveyed a meaning rather than being merely decorative.

Kodumanal (11° 6' 42" N; 77° 30' 51" E) in Perundurai taluka, Erode District (formerly Periyar District), is located on the north bank of the east-flowing river Noyyal, a tributary of the Kaveri. It is about 15 km west of Chennimalai, a famous weaving centre and 40 km southwest of Erode. Agriculture consists of dry cultivation dependent on monsoon rains and supplemented by well irrigation. Raising cattle and sheep supplements the meagre income from agriculture.

The antiquity of Kodumanal was first noticed by V.N. Srinivasa Desikan (IAR 1957-58: 38) as far back as 1961. In 1980 a trial excavation was made by the Tamil Nadu State Archaeology Department. The real archaeological potential of this site was established by the author (Rajan 1990: 95-102, 1991: 111-112, 1994: 57-89, 1996: 72-86). The author's exploration in this region located more than 200 megalithic sites (Fig. 1).

Kodumanal lies on the ancient trade route connecting Karur, the Chera capital of the Sangam Age, and Musiri, the port city on the Kerala coast via the Palghat Gap (Fig. 2). *Kodumanam*, occurring in the Sangam text *Patirruppattu* as a bead making centre, is identified with this site which is situated in the midst of a zone where semi-precious stones occur.

This habitation-cum-burial site covering an area of 150 acres was first excavated by the Department of Archaeology, Tamil University in the year 1985. The subsequent second, third and fourth seasons of the work were carried out respectively in March-June of 1986, 1989 and 1990. A total of 48 trenches were laid out on the habitation mound in eight different locations and 13 burials were opened. On the basis of the cultural remains, the deposit was divided into two periods namely the Megalithic period and the Early Historical period datable respectively to 3rd c. B.C.–1st c. A.D. and 1st c. A.D. to 3rd c. A.D.

People of the first period were mostly artisans and of the second period were cultivators. In period I beads of semi-precious stones such as beryl, carnelian, quartz (Fig. 3), amethyst, sapphire, agate, lapis lazuli and cat's eye, potsherds some with graffiti marks and others with personal names in Brahmi script (Fig. 4 and 5), crucible and iron smelting furnaces and Russet Coated Ware are some of the important findings. In period II terracotta and glass objects, storage pits and Red Ware dominate. Thus, in the early phase the economy was dominated by industrial activities hereas in the later phase the economy was dominated by agricultural activities. Along with the industrial activities, trade was also more important in the first phase.

The burial complex belongs to period I and consists of more than 150 burials scattered over an area of 100 acres to the east and northeast of the habitation. The main type of Megalith is a cairn circle entombing a cist burial. Among these there were three cairn-circles which have a menhir-like monolithic slab planted on the periphery (Fig. 6).

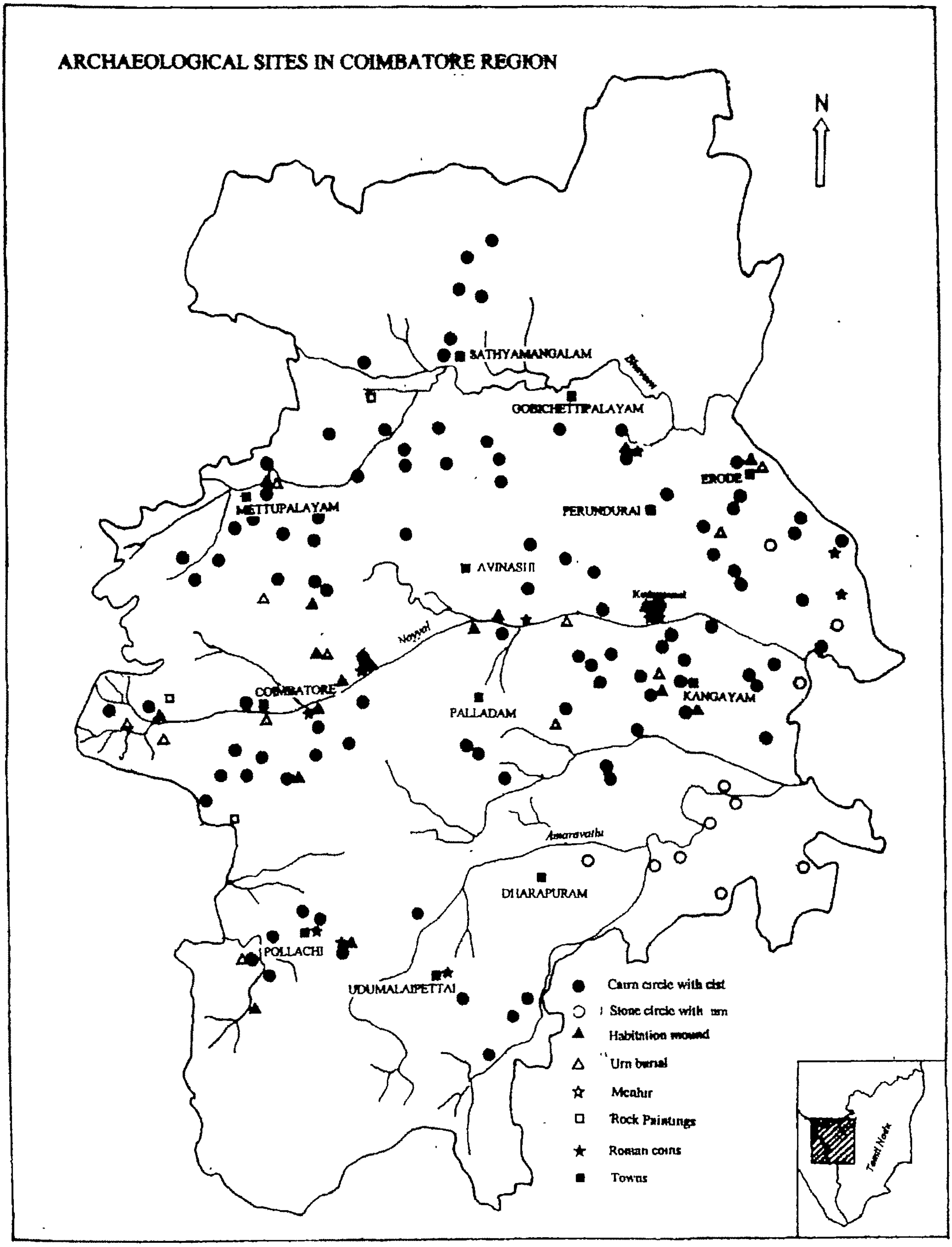

Fig. 1: Archaeological sites in the Coimbatore region

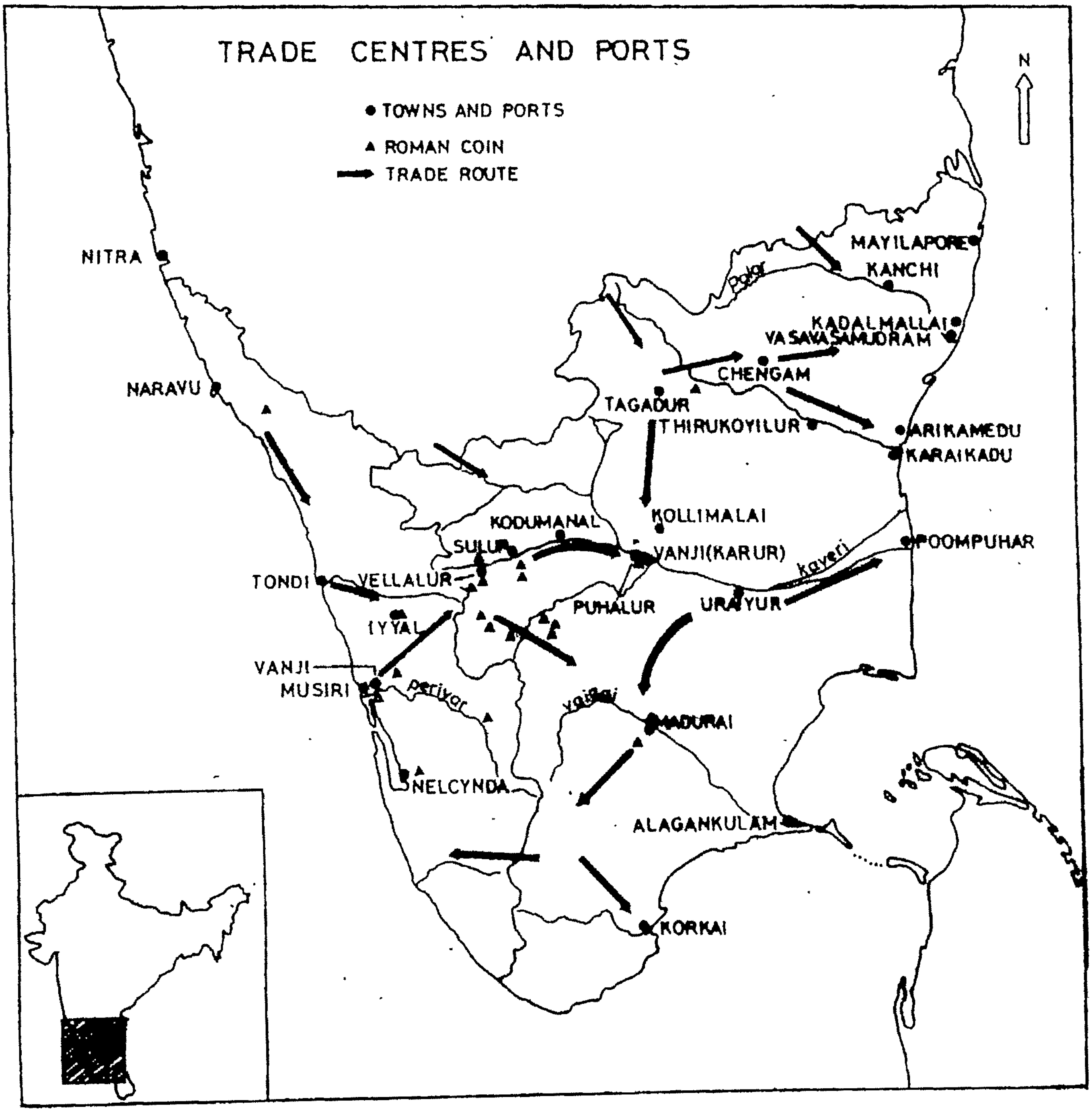

Fig. 2· Ancient trade routes in Tamil Nadu

Fig. 3: Quartz beads

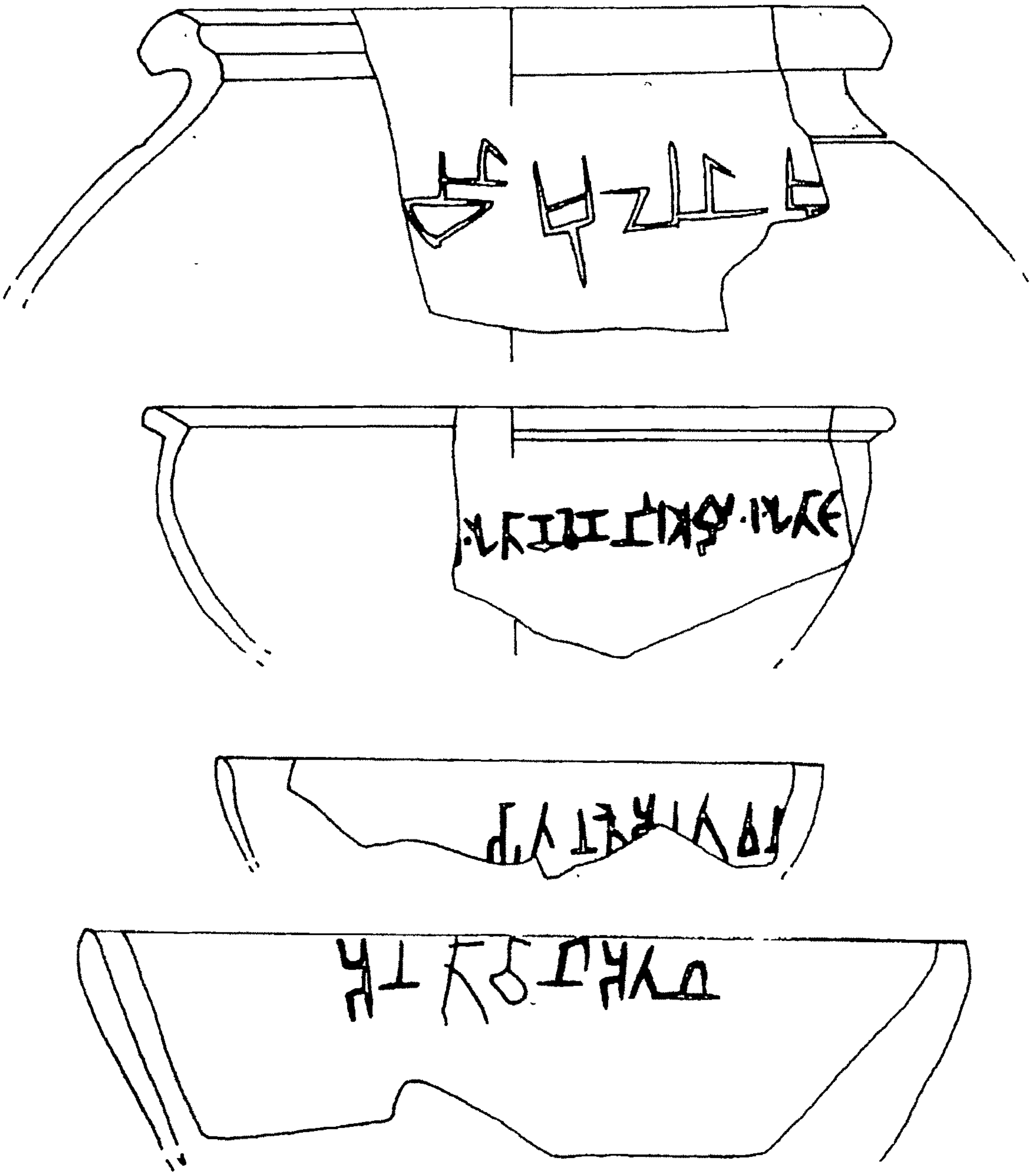

Fig. 4: Sherds with Brahmi inscriptions — *vanmulanm, itanvenniralitada, satantaiantavan, antavan atan*

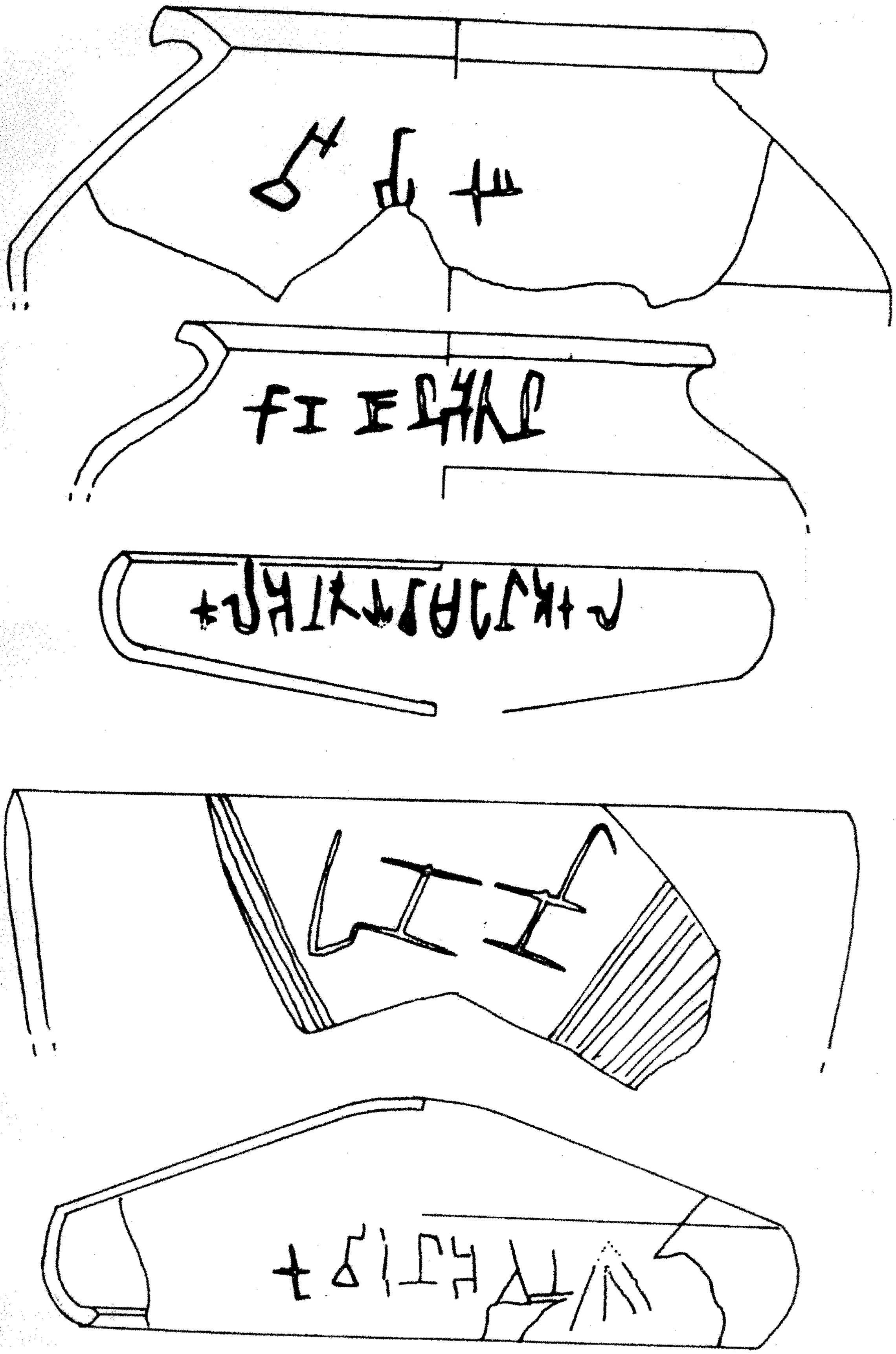

Fig. 5: Sherds with Brahmi inscriptions — *visaki, kannan atan, kulantai camban akal, pannan, kuviran atan*

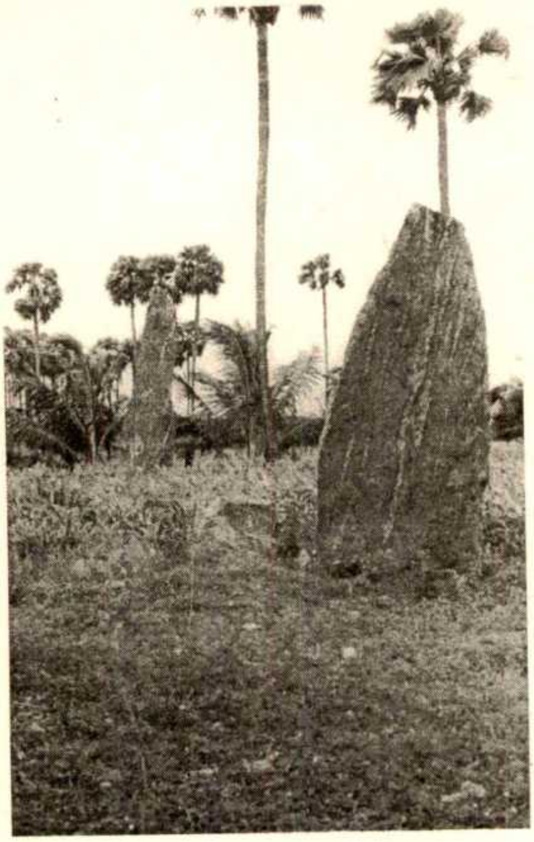

Fig. 6: Menhir planted as a part of a cairn circle

The findings of the earlier excavations have already been reported (Rajan 1990: 92-102; 1991: 111-112; 1991a: 47-54; 1996: 72-86). In this paper, the fifth phase of the work which was carried out jointly by the Department of Archaeology, Tamil University and Tamil Nadu State Archaeology Department in May-June 1997 is reported. Six trenches were laid in the habitation mound area and a burial (Meg. XIV) was opened. The cultural remains that exposed in the habitation are the same as reported earlier. However the burial has yielded new and quite interesting evidence.

Megalith XIV

Megalith XIV (Meg. XIV: was located about 31.60 m southeast of Meg. I and 22.25 m northwest of Meg. VIII) was a cairn circle enclosing a transepted cist with a subsidiary cist erected on its northeastern side (Fig. 7). At present the cairns rise 1 m above the ground level with a flattened top. The capstone was absent except for a few fragmentary portions about 20 cm thick and found in both the chambers of the cist.

Circle

The burial comprises two circles in which the 10 m diametre outer circle was made up of 15 rectangular slabs planted almost at regular intervals at a distance of 50 cm from the inner circle (Fig. 8). These vertical slabs with 2.5 cm U-shaped chisel marks had an average breadth of 1 m and rose 50-75 cm above the present ground level. The whole purpose of this outer slab circle is to keep the inner circle intact. The gap between the outer slab circle and inner boulder circle is packed with cairn rubble. The inner circle (9 m dia.) is made of a wall-like structure. The outer face of it is built of stone boulders placed on the ground without any gap between them. Three courses of boulders were seen which rose to a height of 60-70 cm. The inner face is lined with big limestone boulders and filled with small pebbles, thereby forming a wall like structure, 80 cm in breadth (Fig. 9).

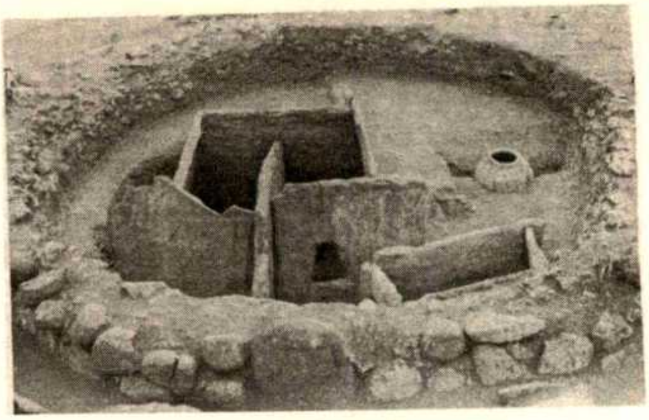

Fig. 7: General view of the transepted cist with one subsidiary cist

Pit

A rectangular pit was dug into the eastern half of the circle to accommodate the cist, passage and subsidiary cist. It measures 5.60 m east-west and 6.20 m north-south having a depth of 1.75 m. The pit had a vertical wall and flat base dug into the hard natural soil.

Cist

The main east-facing transepted cist measured 1.90 x 1.80 m at the top and 2.55 x 2.80 m at the base. It was executed in the eastern half of the circle so as to give enough space at the back of the cist to accommodate the grave goods. The cist was wider at the base and narrower at the top.

Nature of Construction

Rectangular floor slabs were placed on either side of transept slab (2.50 X 1.60 X 0.16 m). Then the western orthostat (2.17 x 1.86 x 0.18 m) was placed against the transepted slab. Subsequently, the northern and southern orthostats measuring 3.20 x 2.05 x 0.10 m and 2.80 x 1.74 x 0.20 m respectively were placed against the western orthostat. On the east it had two orthostats placed on either

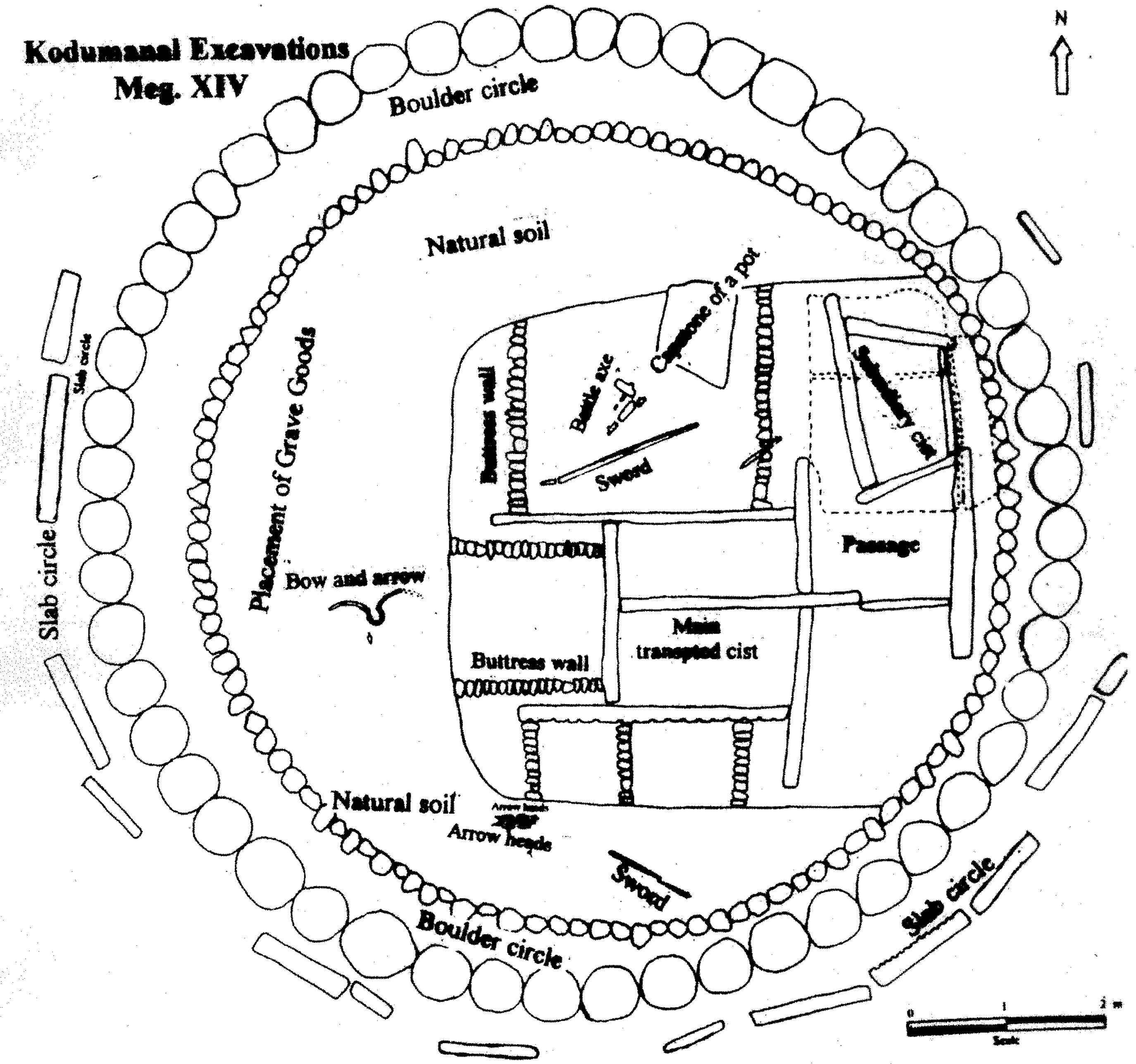

Fig. 8: Ground plan of Meg.XIV

side of the transept slab measuring 2.08 x 1.75 x 0.16 m and 2.10 x 1.72 x 0.15 m respectively placed against the northern and southern orthostats. The transepted slab projected into the passage for about 50 cm and it was 10 cm less in height than the northern orthostat. All the orthostats were supported by a small rectangular slab at the base. The rectangular floor slab of the southern chamber was intentionally broken at the middle in its northern half leaving a wide gap. In this gap a small pit is observed. The purpose of this gap and the pit would have been to accommodate the water or any other liquid material that could have flowed while performing some ritual at the time of placing the human skeletal remains on the floor slab.

Subsidiary Cist

Instead of the usual two subsidiary cists, this burial had only one south-facing subsidiary cist built against the

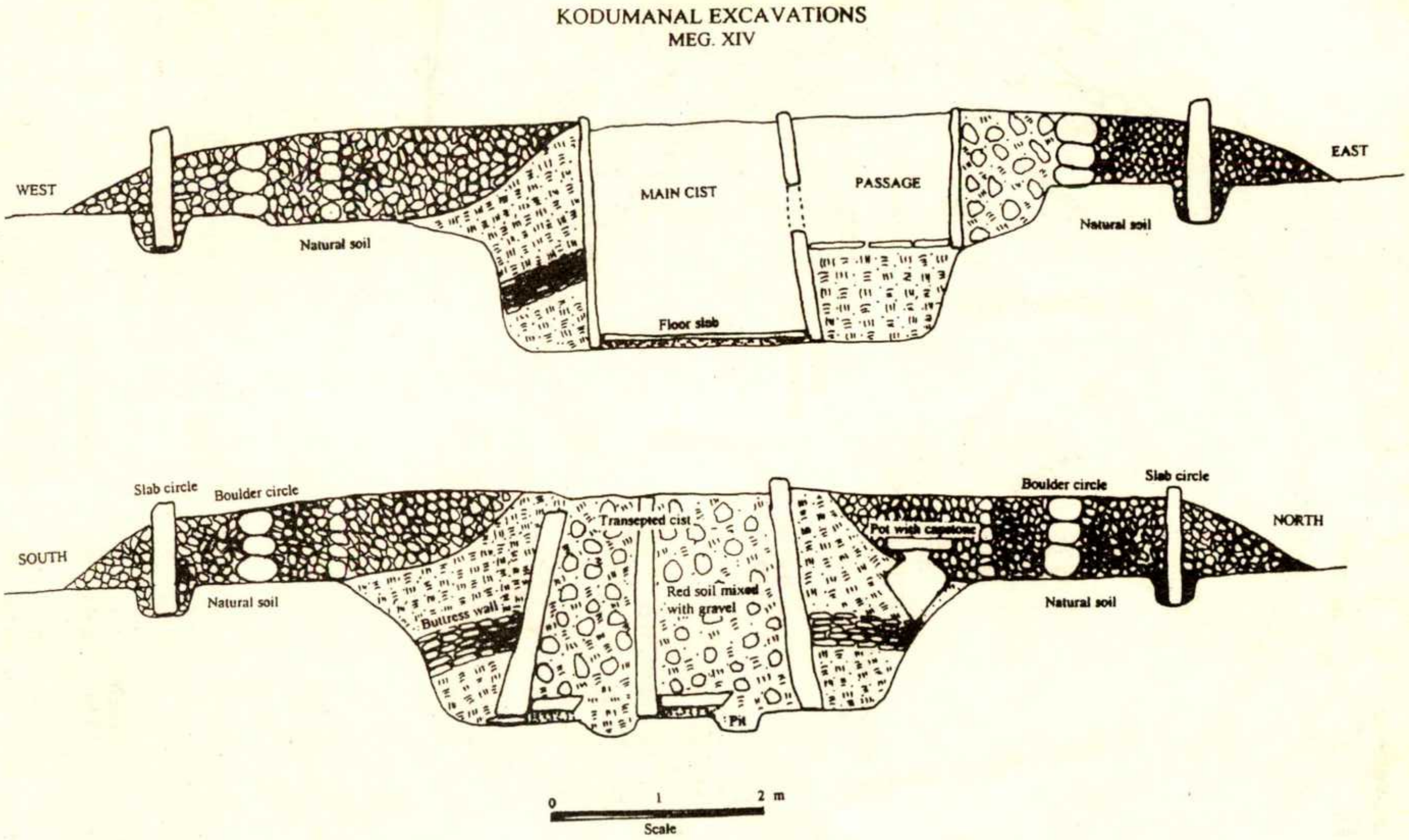
KODUMANAL EXCAVATIONS
MEG. XIV

Fig. 9: Cross section of Meg. XIV

passage on the northern side of the main cist. This rectangular box-like structure measuring 1.50 x 0.90 m was built of four orthostats and one base slab. This simple cist was built as follows. The floor slab was placed first and then the eastern orthostat erected. It stands vertical as its northern edge rested on a pitwall and its southern edge leaned on the closing slab of the passage. Subsequently the northern, southern and western slabs were put in place. This cist does not have any interlocking *swastika* pattern system. A capstone measuring 2.10 x 1.90 x 0.20 m perfectly covered this cist.

Passage

The rectangular common passage measuring 1.40 x 1.10 m was formed by the orthostats of the cist with two additional slabs. The frontal slabs of the northern chamber of the main cist and the subsidiary cist served as the western and northern wall of the passage. On the southern side, a vertical slab measuring 1.40 x 0.90 x 0.10 m was fixed to fit between the edge of the transepting slab and closing slab of the passage. This closing slab was placed resting against the frontal slab of the subsidiary cist and southern slab of the passage.

Generally the passage covers both the chambers of the main cist but in this burial the passage is noticed only against the northern chamber of the main cist. From this burial one point is very clear that the passages are built only against the portholes. For instance the earlier excavated burials as in Meg. I, II, V, VIII and X had portholes against each chamber of the main transepted cist so that the passages were also built in such a way as to cover both the chambers. In this case as well as in Meg. III the frontal slab of the southern chamber does not have any porthole and it is present only in the northern chamber. Hence the passage is confined to these chambers. Therefore the functional aspect of the passage is to provide enough space to perform rituals against the porthole. This is further confirmed by the occurrence of antiquities placed near the porthole.

Buttress Wall

Buttress walls made of rubble were placed in the gap between the pit wall and the orthostats so as to keep the orthostats intact and to avoid their inward collapse. These walls continued from the base to the top edge of the pit wall.

Contents of the Cist

In both the chambers of the main transepted cist, the antiquities were meagre except for a few animal bone pieces found at the top level and a human bone piece on the floor slab. The human bones are fragile due to the nature of the soil and are not identifiable. The packing material was almost identical to the surrounding soil. Reddish compact soil mixed with gravel was found up to a depth of 40 cm. Below this occurred limestone that was found in a large quantity opposite the porthole. Below the porthole level the soil turned brownish and loose. Charred earth was noticed against the porthole.

The subsidiary cist up to the base was filled with a very fine brownish loose soil. It seems this soil was prepared specially for the occasion. Like the main cist, this cist also failed to yield any grave goods.

Porthole

Two portholes were noticed, one in the subsidiary cist and another in the main cist. The front slab of the northern chamber of the main cist (Fig. 7) has a trapeze shaped porthole. It measures 23 cm at the top and 46 cm at the base with a total height of 54 cm. In all the previous excavations, the chambers were directly or indirectly connected with portholes made either on the transepted slab or on the frontal slab. Quite interestingly, in this burial the southern chamber is not connected with any porthole. However the top edge of the eastern slab is broken and it is possible that a porthole was present in the broken part.

An arrowhead-shaped porthole, noticed on the front slab of the subsidiary cist is quite interesting. It measures 115 cm in height with a 40 cm hilt portion. The width of the hilt is 18 cm. The maximum width of the arrow is 42 cm. Earlier in Meg. I, II, V and X flower pot or Latin cross-shaped portholes were observed. It seems these portholes too must have been shaped like an arrowhead but due to the nature of breakage they appear like a flower pot. This perfectly preserved arrow-head shaped porthole shows the shape of the original portholes. The occurrence of a large quantity of arrow heads against the portholes in Meg. II, V and X, supports the identification of the porthole shape with an arrowhead.

Grave Goods

Grave goods were placed around the main cist and in a pot placed on the northern side of the main cist. The grave goods consist of pots, bowls and dishes made of Black and Red Ware, four legged jars of Red Polished Ware and iron objects. These were placed around the cist but away from the pit line. Though they were placed uniformly, most of them could not be recovered due to the cairns dumped upon the grave goods. As in the other burials, the four-legged jars were kept near the inner edge of the circle. A fragmentary portion of a big storage jar with conical base was noticed on the southern side of the cist.

Iron Objects

Four swords, 17 arrowheads, two bow-like objects, one battle axe and a knife are some of the objects recovered from the burial. These objects were placed at two levels.

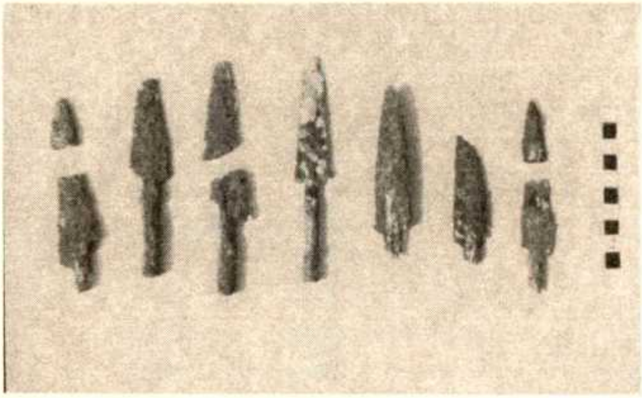

Fig. 10: Arrowheads

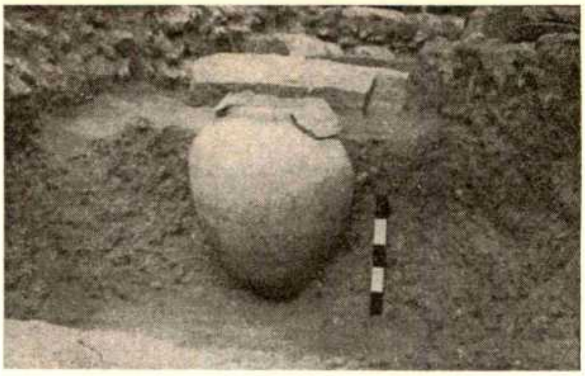

Fig. 12: Pot placed with a capstone on the northern side of the cist

The first set just below the cairn packing but 60-80 cm above the ground level; and the second on the top edge of the pit marking but away from the pit lines. In the first set a long sword measuring 1.70 cm in length and 4 cm in breadth was placed on the northern side of the main cist and oriented east-west with its tip to the east. Interestingly, a conical shaped wooden handle impression was noticed on its western end. The impression was 15 cm in length. An arrowhead was also placed near the sword. A bow-like structure measuring a maximum length of 120 cm and height of 43 cm placed at the back of the cist but near the inner edge of the circle. Identical objects were found just 60 cm below the sword mentioned earlier. In both the cases, an arrow head was placed near it symbolically indicating the purpose of this object. The shape of the bow is similar to the bow depicted on the obverse of the Chera coins collected in and around this region. At Karur a bow figurine is also identical. Besides the above objects at the ground level a sword measuring 11 x 2 cm was placed on the northern side of the cist. A few metres west of this object a battle axe measuring 15 cm in length and 6 cm in breadth at the centre and 3 cm at the edge was discovered. At the base of the cist near the inner edge of the circle and 60 cm below the earlier reported bow-like object a bunch of arrowheads were noticed. Likewise on the southern side, near the inner edge of the circle, 12 more arrowheads were found along with a copper strainer. Just a few metres eastward of these objects two swords measuring 75 x 3 cm each placed in an east-west orientation with their tips facing each other were found along with a few arrowheads. These arrowheads are generally 14 cm in length in which the shaft is about 7 cm. The tip was 5 cm in breadth and the broader portion above the shaft was 2.5 cm in breadth. There are three types: pointed shaft, cylindrical hollow tip and barbed arrow head with cylindrical shaft (Fig. 10). Therefore, the wood was inserted into the cylindrical shaft whereas the pointed shafts were inserted into the wood.

Copper Object

This interesting object resembles a strainer or a filter (Fig. 11). It measures maximum diametre of 17 cm at the top and the cup with fine perforation noticed at the centre had inner diametre of 2 cm and depth of 6 cm. This copper object is rivetted to an iron handle. Near to this, 12 arrow heads were placed. This object demonstrates the megalithic

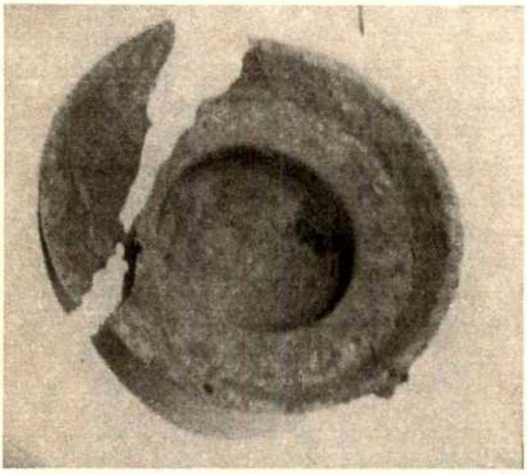

Fig. 11: Copper strainer

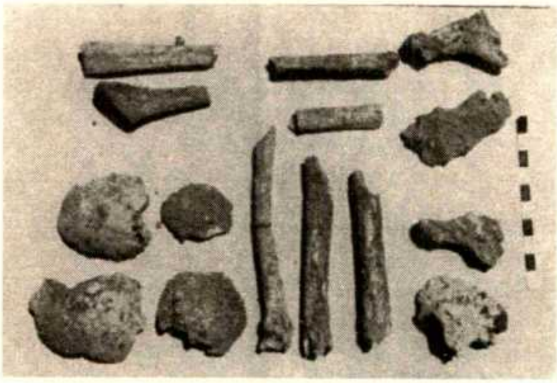

Fig. 13: Deer bone pieces collected from the pot (urn)

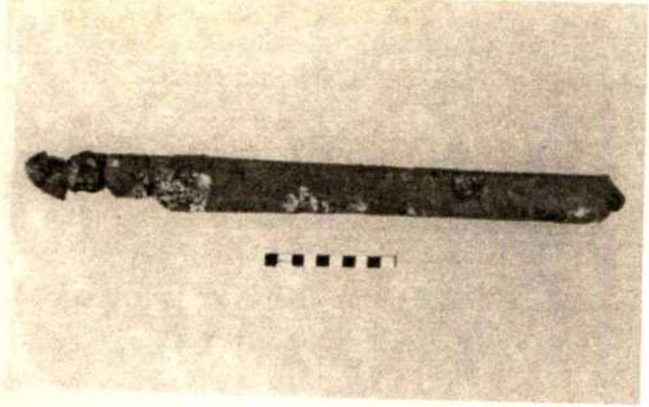

Fig. 14: Sword collected from the pot

people's mastery over metal technology. An almost identical object was collected earlier from Meg. XI.

Urn Burial of a Deer

An interesting feature observed in this burial is of an urn placed on the northern side of the main cist near the pit wall (Fig. 9). This conical shaped urn with 5 cm short stem base had 22 cm wide mouth with 5 cm heavy rolled rim, very short neck and bulbous body at the shoulder. It measures maximum of 95 cm in height and 80 cm in diametre at the shoulder portion. The 5 cm thick urn was closed with a lid of a Black and Red Ware. This lid was crumbled due to the weight of the capstone placed over it. The rectangular capstone measures 1.20 x 0.75 x 0.20 m (Fig. 12). The pot contains deer bones probably sacrificed for the dead, a sword, an axe and 785 etched carnelian beads. It seems the deer was sacrificed and cut into pieces so that it could be pushed through the mouth of the pot (Fig. 13). Though the main body of the deer is in an articulated form, the head and legs were placed on the body of the animal. After placing the deer, a sword measuring 13 x 3 cm was placed in slanting position with tip pointing upwards and hilt touching the bottom portion of the pot (Fig. 14). Along with the sword, a double edged axe is placed in the centre (Fig. 15). A necklace consisting of 430 disc shaped and 355 barrel shaped etched carnelian beads was placed on the northern side of the sword touching the wall of the pot (Fig. 16). While animal bones were recovered in earlier excavated burials none of them were found placed in a separate pot.

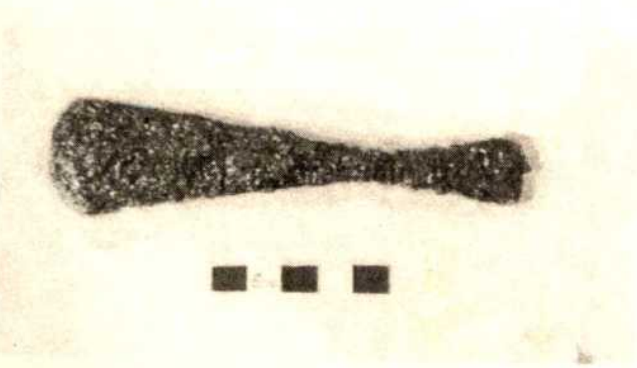

Fig. 15: Double edged axe collected from the pot

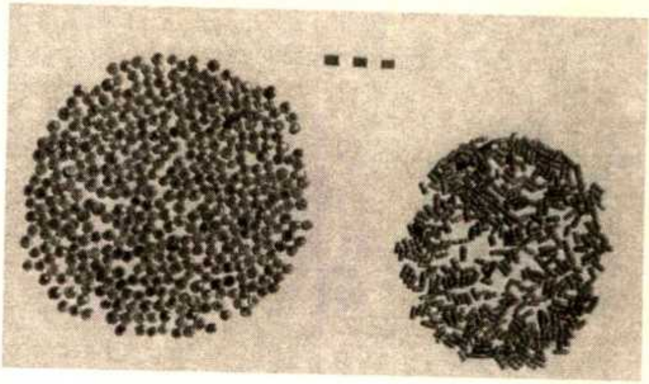

Fig. 16: Etched carnelian beads collected from the pot

Graffiti

Two types of graffiti marks were noticed in this burial. The first type has a vertical line at the centre and two slanting lines on either side with all the three meeting at a single point at the top. The right side slanting line has a wavy line pattern.

The second one is identical to the first one except both the slanting lines are wavy.

The first type of graffiti mark is confined to bowls whereas the second type is confined to lids. What meaning is sought to be conveyed through this differentiation is very difficult to discern at this stage. But identical graffiti marks were noticed in the earlier burials too and were identified as a clan symbol based on the type of burial, grave goods and location (Rajan 1991a: 47-54) .

Conclusion

The excavation at Kodumanal has yielded important data on the megalithic culture. The megalithic people were involved in an industrial based economy with the manufacture of steel, iron, cotton fabrics and semi-precious stone beads. They used an archaic form of Tamil-Brahmi script that can be dated to the 3rd Century B.C. The graffiti marks are used in the early stage. It seems this graffito lost its significance once the Tamil-Brahmi script came into existence. The relationship between the habitation and burial is clearly established in the form of potsherds like Black and Red Ware and Russet Coated Ware found both in the habitation and burial with graffiti marks and Tamil-Brahmi script. This was further supported by the carnelian beads, iron and copper objects. Due to the nature of the industry, the megalithic people were actively involved both in domestic and foreign trade as attested to by the Roman objects like coins, Rouletted Ware, and a terracotta figurine of Roman origin. The volume of trade, the use of a script, the nature of industries and the size of the megalithic monuments clearly proves that the megalithic people were not nomads.

The construction of funerary monuments also provides an insight into the social organisation, petrological knowledge, engineering and technological skills, size of the population and their beliefs and customs. The distinctive graves, graffiti marks, and the amount of grave goods noticed within the burial complex might suggest that the burial was that of some chief or important person in the community.

Acknowledgement

I am grateful to the Department of Archaeology, Govt. of Tamil Nadu for extending financial support to the excavation. Shri Natana Kasinathan, Director of Tamil Nadu State Archaeology Department, took all the initiative for a joint programme with the Tamil University, I am grateful to him. Sarvashri Abdul Majeed, Superintending Archaeologist. Shri R. Poongundran and Shri K. Sridharan, Registering Officers, Shri R. Selvaraj, Shri R. Ramamurthy, Shri T. Subramaniam, Shri K. Munisamy, Shri Gutamaputhiran and Shri Sridharan of the State Archaeology Department and Shri N. Athiyaman and Shri K. Pannerselvam of Tamil University were actively involved in the excavation programme; I thank them all.

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Archaeology of Bet Dwarka Island

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Abstract

Explorations along the shore and in the intertidal zone at Bet Dwarka island were carried out by the Marine Archaeology Centre of National Institute of Oceanography (NIO), Goa between 1981-1994. Artefacts of both the protohistoric and historic period were found. The former include a seal, inscriptions and pottery, while the latter consist of coins and pottery. The earliest settlement at Bet Dwarka may be dated to the late phase of the Indus Civilization, i.e. c. 1400 B.C. Bet Dwaraka then was perhaps deserted for several centuries and was re-occupied in the 3rd century B.C.

Introduction

Islands such as Bet Dwarka had played a dominant role in the maritime history of India. Maritime trade with India is attested to in Mesopotamian texts where the word *Meluhha* refers to the western part of the Indian subcontinent. The Indus Valley inhabitants had trade with Mesopotamia. The Kachchh and Kathiawar coasts are famous for the conch shell (*Turbinella pyrum*) which was used during the Indus Civilization for making ornaments (Marshall 1973: 170, 219).

One of the attractions of Bet Dwarka to the early settlers could be the vast potential of the conch shell. Marine archaeological explorations at Bet Dwarka have brought to light a large number of antiquities belonging to the protohistoric period which include a seal made on a conch shell and two inscriptions on potsherds as well as chert blades and pottery.

This paper is a review of the archaeological findings of the marine archaeological explorations conducted at Bet Dwarka from 1981 to 1995 and discusses a few problems regarding the findings of the antiquities at Bet Dwarka.

Description of the Area

Bet Dwarka island (22° 22'12" N to 22° 28' 36 N and 69° 05'03" E to 69° 09'02" E), is situated in the Gulf of Kachchh about 5 km north of the mainland off Okhamandal and to the east of Okha port. It is famous for temples dedicated to Lord Krishna. Bet Dwarka also known as Bet Shankhodhar, is a narrow crooked strip about 13 km long and consists of sand and rock. The eastern part of the island comprises sand-hills and bushes and is called Hanuman point. Its south-west half is a rocky tableland 17-20 m AMSL. The geological formations of Bet Dwarka are mostly Upper Miocene and Pliocene marls and arenaceous clays capped by a sandy limestone and a hard calcareous sandstone. These indicate a littoral to epineritic depositional environment, somewhat similar to that of the underlying Gaj clays over which they rest with a disconformity (Merh 1995: 123).

Previous Work

An Early Historic site was excavated near Nilkantha Mahadev and behind Dhingesvar Mahadev temple, and a potsherd inscribed *Nandakasa* in Mauryan Brahmi script suggests a 3rd century B.C. or slightly earlier date for the settlement (Rao 1988: 48). Exploration of the island led to the recovery of a few sherds suspected to be of protohistoric but not specifically Harappan affinities (Rao 1987: 27). Onshore explorations yielded a number of potsherds belonging to the protohistoric period in the cliff sections near Siddi Bawa Pir, the southeast point of the island (IAR 1979-80: 29).

Explorations by the Marine Archaeology Centre

Onshore and intertidal zone explorations between 1981 and 1994 brought to light a large number of antiquities at BDK-I, II, VI and IX (Fig. 1).

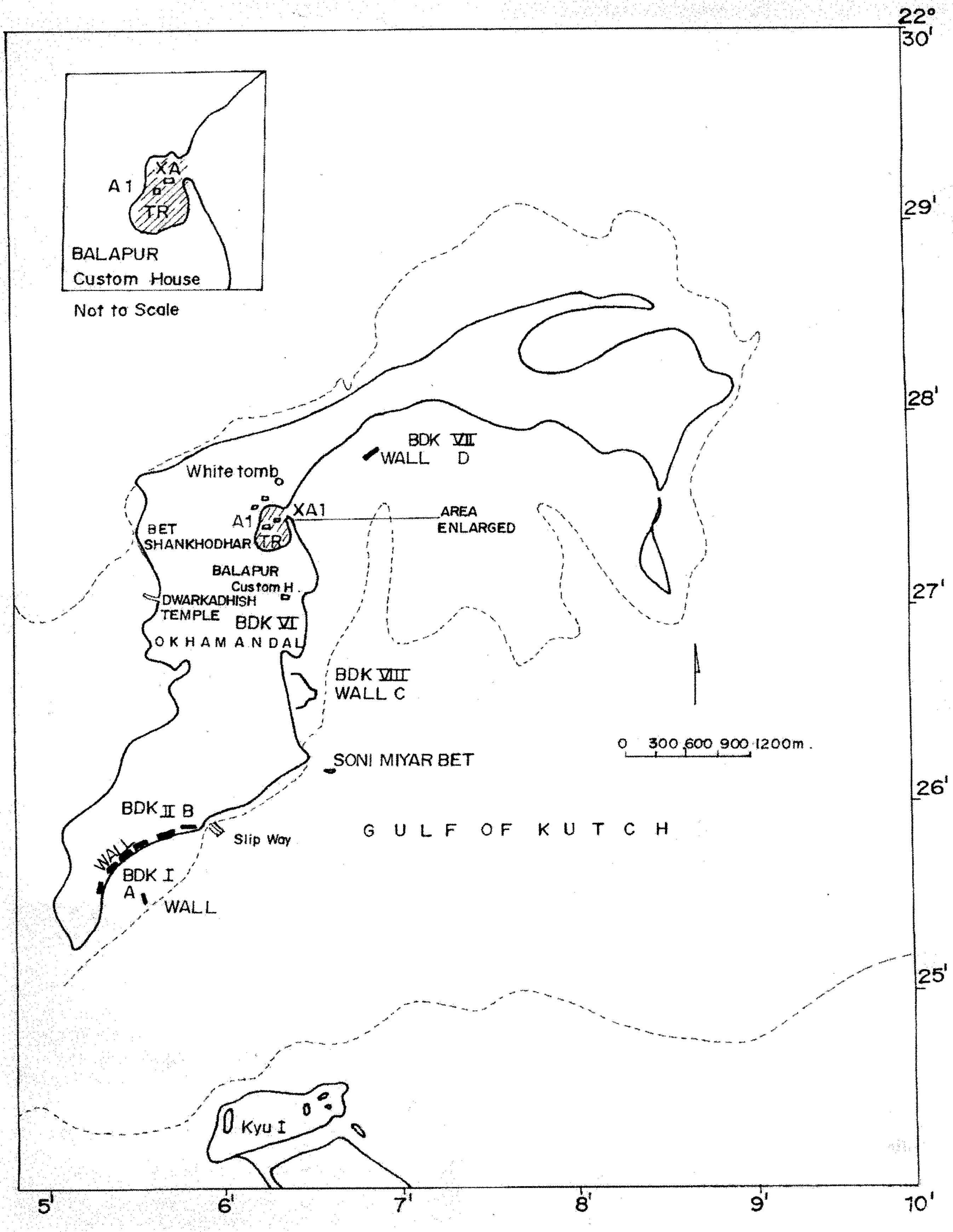

Fig. 1: Location map of Bet Dwarka island

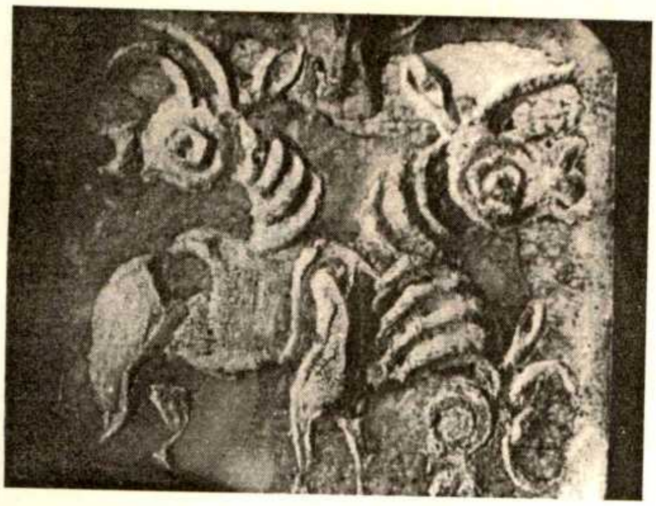

Fig. 2: Indus-type seal with a composite animal motif (anti-clockwise bull, unicorn and goat)

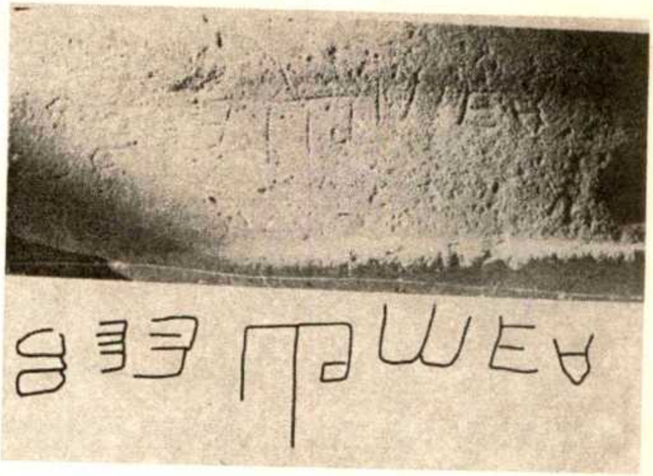

Fig. 3: Seven character inscription on a potsherd

The findings of Bet Dwarka may be divided into two broad periods, i) the protohistoric, which includes a seal, two inscriptions and Late Harappan pottery, and ii) the Historical, which consists of coins and pottery. Due to the absence of a dated stratigraphic context it is not possible to assign a definite age to the shell objects.

Period I (Protohistoric Period)

The protohistoric period (3500 to 1000 B.C.) in Indian archaeology is represented by the Indus Valley Civilization, the Chalcolithic culture of the Deccan and the early Megalithic culture of south India. In the case of Bet Dwarka island the earliest date of settlement may be the late phase of the Indus Civilization on the basis of TL dating of pottery (Rao 1988: 72).

Seal

A conch shell seal is the most important diagnostic antiquity from the island. It is 20 x 18 mm in size with a three headed animal motif representing a short-horned bull, a unicorn and a goat engraved on it and a perforated knob on its back for holding a ring (Fig. 2). The seal is similar to the one reported from Mohenjo-daro (Marshall 1973: seal no. 382). It was found during the underwater excavation from layer 2 of a trench UW 6 measuring 1 x 1 m, which was laid 400 m seaward of the rocky promontory projecting between BDK I and BDK II (Rao 1990: 72). It has been suggested that the shape and details of the seal could not have remained intact underwater (Tripathi 1996: 53) thus casting doubts on its integrity. The suspicion is illfounded because several well preserved fragile terracotta and ivory objects have also been found from Bronze Age shipwrecks in the Mediterranean waters (Throckmorton 1987: 32). In this case, the seal is made of conch shell which is perhaps one of the hardest shells in the sea. As the seal was found buried under sediment the excellent preservation can be easily explained. Therefore, its preservation as well as location are beyond any reasonable doubt although the early date of the settlement at Bet Dwarka may be argued.

Inscriptions

Of the two protohistoric inscriptions on potsherds found at Bet Dwarka, one has seven characters (Fig. 3) and the other (Fig. 4) has two characters. The former was found in the intertidal zone (Rao 1988: 82) and the other during the onshore explorations. Rao (1987: 52) deciphered the first inscription as *mahagacha-shah-pa* which according to him means "Sea Lord Protect" and the second as *Baga* meaning "God". It is difficult to comment on the decipherment of

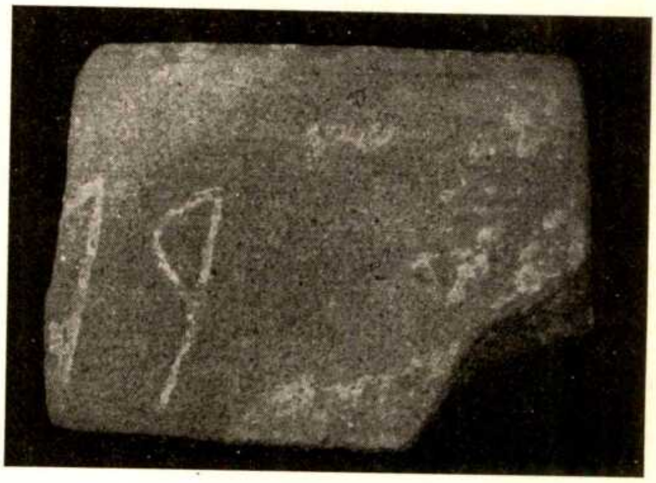

Fig. 4: Two character inscription on a potsherd

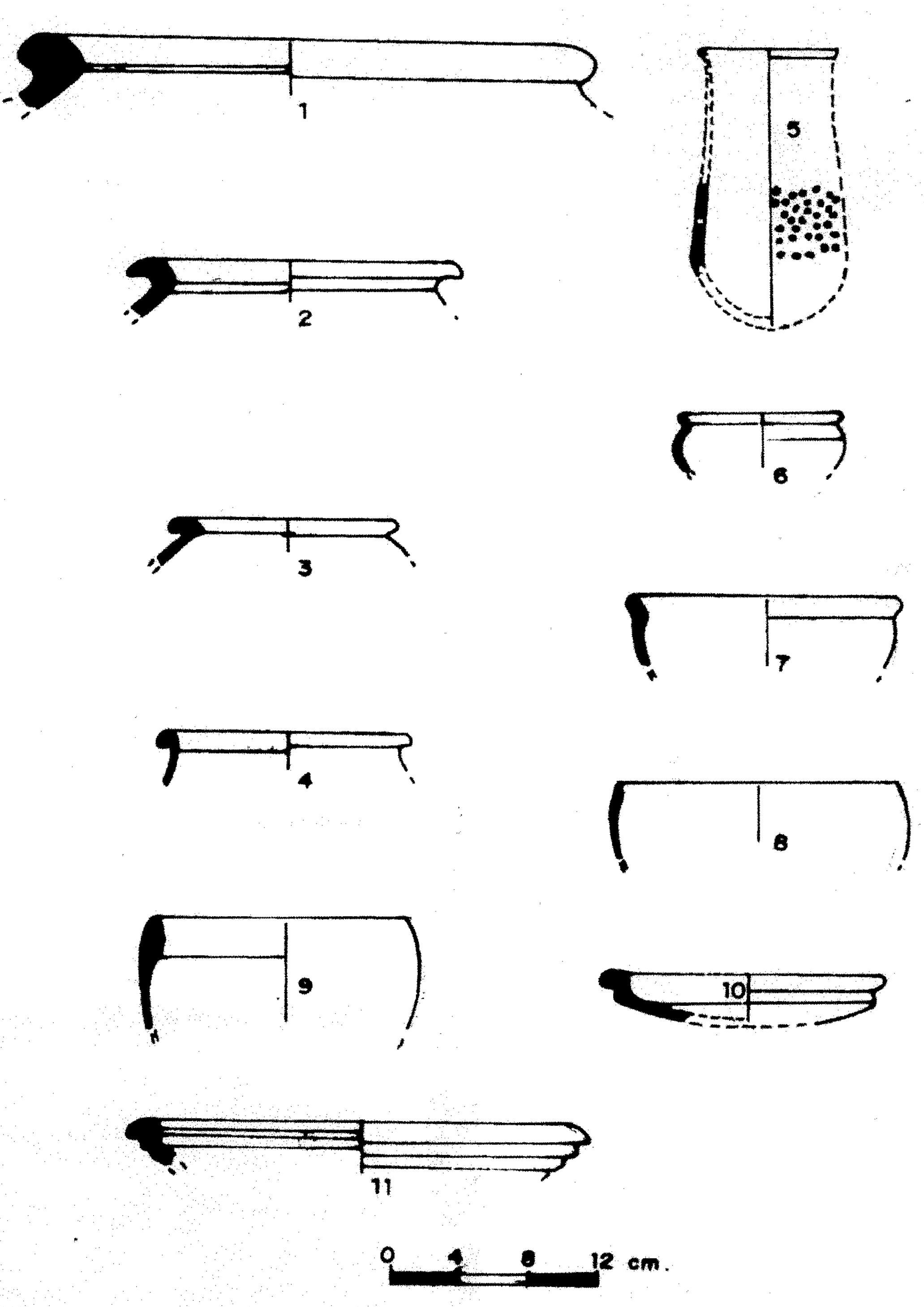

Fig. 5: Protohistoric pottery from Bet Dwarka

this script till all the Harappan scripts are decoded conclusively. However Tripathi (1996: 53) disputes the script on the potsherd since it was recovered from the intertidal zone. It is possible that the potsherd could have recently fallen out of the section facing the sea and therefore the script is similar to the other graffiti marks on the Harappan potsherds. There are also clear differences between the two inscriptions (Fig. 3-4). The inscription on the potsherd from the onshore zone is intact while that one from the intertidal zone is faint and therefore it is difficult to identify the characters. The finding of these potsherds with inscriptions also helps in dating the habitation of Bet Dwarka island.

Pottery (Fig. 5)

Pottery has been collected from both the intertidal zone as well as onshore at Bet Dwarka (Gaur *et al.* 1994: 165). Most of the pottery found is fragmentary because of wave action. Some shapes such as perforated jars, carinated dishes and parts of a dish-on-stand in sturdy Red Ware, bowls in Red Ware and Grey Ware, high-necked jars in Coarse Red Ware, assignable to the protohistoric period are found at all Harappan and Late Harappan sites and were found in both the intertidal and onshore collections. Most of the protohistoric pottery of Bet Dwarka is comparable with the pottery of Rangpur IIC-III, which was excavated extensively.

The Red Ware sherds are sturdy with a red core, while the Grey Ware has a light to deep smoky core. The clay used for the Red Ware is fine except in the case of the big storage jars where the clay is coarse.

The pottery is mostly wheel-turned. Pots with a bulbous or carinated body are turned on a wheel and without touching the rim and neck.

The sherds recovered from the intertidal zone have a pitted surface from which all evidence of surface treatment including paintings has been lost. Pottery collected from the surface exploration is decorated on the shoulder and rim portions. Painted decorations appear only on the Red Ware and are in the form of horizontal bands and roundels on the bowls. These decorations are executed in black and chocolate colour.

Jars

1. Thick storage jar with a heavy beaded rim and bulbous body, ill fired, coarse fabric. BDK-II 85 (compare with RGP III, type 61).
2. Jar with a bulbous body and sharp projecting rim, well fired, coarse fabric. BDK II-85 (compare with RGP IIA, type 3).
3. Jar with a wide mouth, splayed beaded rim and bulbous body, well fired, fine fabric. BDK-VI 88 (compare with Lothal B type 237 B).
4. Jar of medium size with raised neck and beaded rim, well fired, medium fabric. BDK-IX 90 (compare with RGP III, type 70).
5. Body part of a perforated jar with a medium thickness, well fired, medium fabric. BDK-I 85.

Bowls

6. Bowl with a sharp and everted rim, blunt-carinated shoulder, red slip and painted in chocolate colour with roundels, well fired, fine fabric. BDK-VIB 87 (compare with RGP IIC, type 10 a).
7. Bowl with a thick rim and straight sides, slightly convex profile, well fired, medium fabric. BDK-IX 90 (compare with RGP IIB, type 29).
8. Convex sided bowl with a thick rim, red slip, well fired, fine fabric. BDK-IX 90 (compare with RGP IIC type 10 a).
9. Convex sided bowl with a thick rim, red slip, medium thickness, fine fabric, well fired. BDK IX 90 (compare with RGP IIC, type 10B).

Dishes

10. Shallow dish with a projecting rim and prominent carinated shoulder, illfired, coarse fabric. BDK-II 85 (compare with RGP IIA, type 76a and also with Lothal A 42f).
11. Dish with a projecting sharp rim, blunt carinated shoulder, well fired, fine fabric. BDK-VI 85 (compare with RGP IIA type 67a).
12. Dish of a dish-on-stand, featureless rim, non-carinated shoulder, well fired, fine fabric. BDK-VIB 87 (compare with RGP IIA, type 77 and also with Lothal A, type 43).

This pottery assemblage suggests that the site was occupied at the beginning of the 2nd millennium B.C. and was contemporary with the protohistoric settlement at Rangpur in Gujarat. X-ray diffraction studies suggest that the suite of minerals of the protohistoric pottery has a close similarities with the local clay and the present-day pottery. This shows that the pottery has been found close to where it was made. The mineralogical study also shows that the people of that time were aware of the properties of the clays and knew which to select as raw material for the pottery (Hashimi *et al.* 1994).

Period II (Historical Period)

After a long interval the island was probably reoccupied sometime in the 3rd century B.C. The excavations at the nearby site of Dwarka (Ansari and Mate 1963) yielded information about the early historical settlement and trade contact with the Roman world around the begining of the

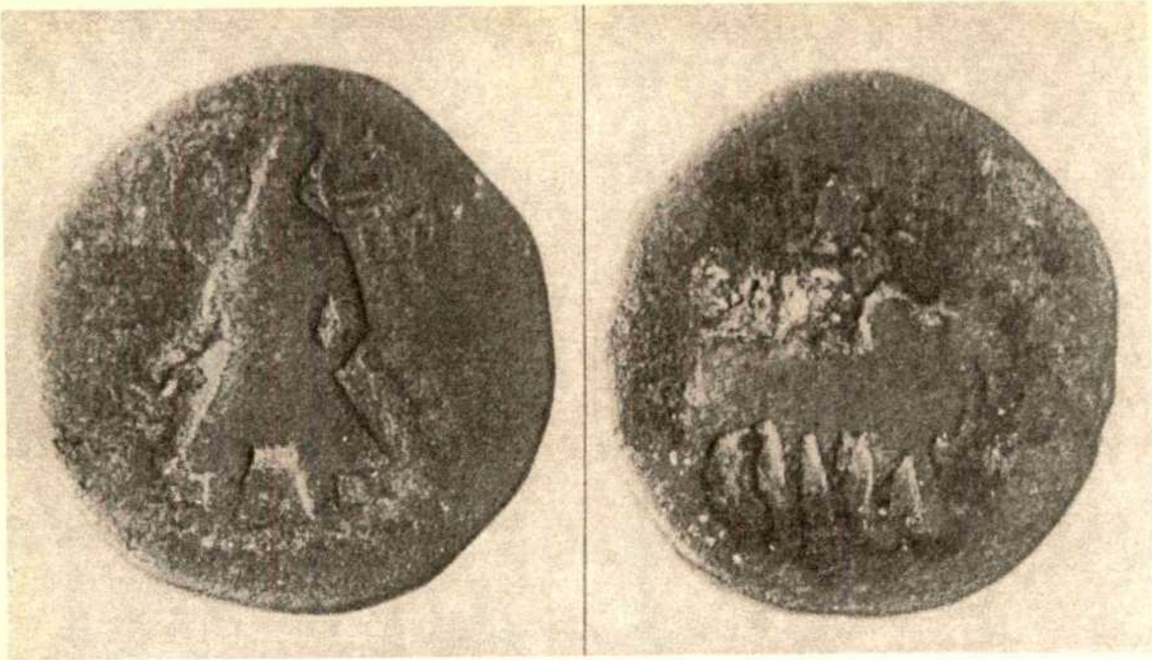

Fig. 6: Kushana period coin discovered during onshore exploration

Christian era. Both pottery and coins were collected from onshore and intertidal explorations.

Coins

Of the four coins collected from the island three are of copper while the other is of lead. Two copper coins are identified as belonging to the Kushana period.

1. A copper coin of the Kushana period (1st century A.D.) weighing 15.9809 gm is well preserved but it is badly worn (Fig. 6). On the obverse there is a standing king to the left, wearing a diadem and helmet, sacrificing at an altar. A short sword is held in the left hand which rests on the waist. The script is not readable. On the reverse it consists of a standing Siva wearing a head-dress with drapery over the shoulder, a trident held in the right hand and a bull standing behind him.
2. The second copper coin belongs to the Kushana period (1st century A.D.), weighs 3.6847 gm and the top portion on both sides is heavily corroded (Fig. 7). On the obverse it consists of a standing and bearded king wearing a conical shaped helmet and offering oblations into an altar with his right hand which also holds an *ankusa*. He is facing left with a fillet flowing on to his shoulder, and he also holds a spear in his raised left

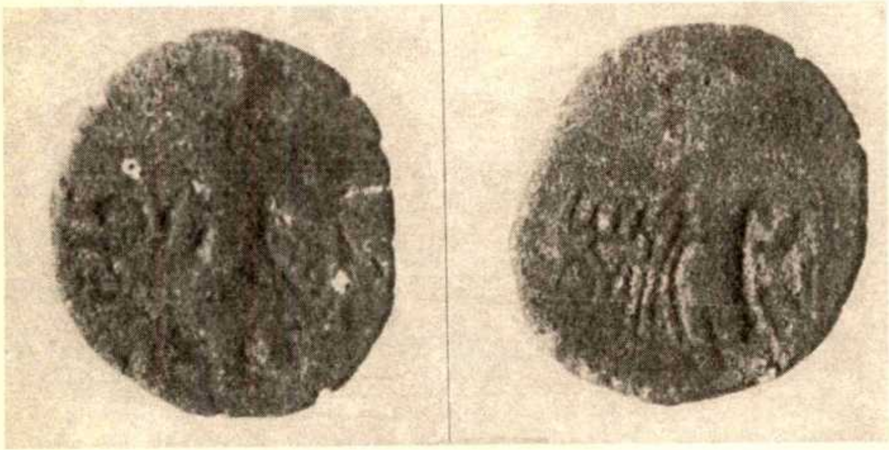

Fig. 7: Kushana period coin discovered during onshore exploration

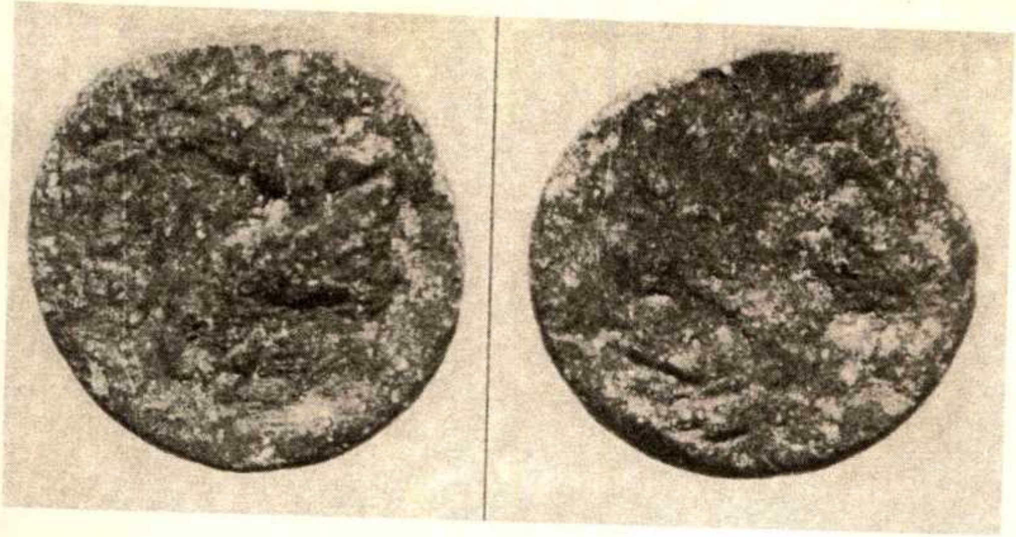

Fig. 8: Unidentified coin discovered during onshore exploration

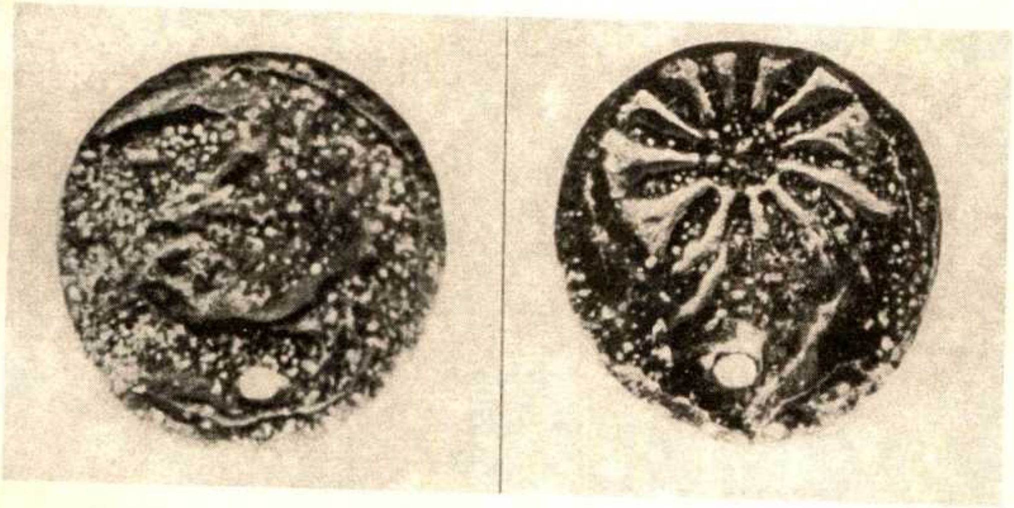

Fig. 9: Unidentified coin discovered during onshore exploration

hand. He is wearing a tunic. The script is not readable. On the reverse is a diademed male standing frontally, facing left and wearing a tunic, mantle, short boots and a low cap tied with a ribbon. The extended right hand makes a peculiar two fingered gesture and he is armed with a short sword held in his left hand which rests on his waist. The script is not readable.

3. Unidentified lead coin weighing 3.4952 gm (Fig. 8).
4. A lead coin weighing 2.1987 gm, (Fig. 9) with a 12 spoked wheel on the obverse. The reverse remains unidentified.

The discovery of the coins suggests that this was an important habitational centre during the historical period.

Pottery (Fig. 10)

The pottery of the historical period is generally mixed-up with that of the protohistoric period, but was separated on the basis of shapes and fabrics. The pottery of the historical period is Red Slipped Ware, Red Polished Ware, Coarse Red Ware and amphorae. The pottery is mostly wheel-turned, and imperfect firing in some cases is revealed by a thin smoky colour line in the section. A few of the important shapes are:

1. Storage jar with a flared rim and bulbous body, short neck, red slip, ill fired, coarse fabric. BDK-I 88.
2. High-necked jar of medium thickness with out-turned and deep undercut, concave neck, red slip, well fired, medium fabric. BDK-II 85.

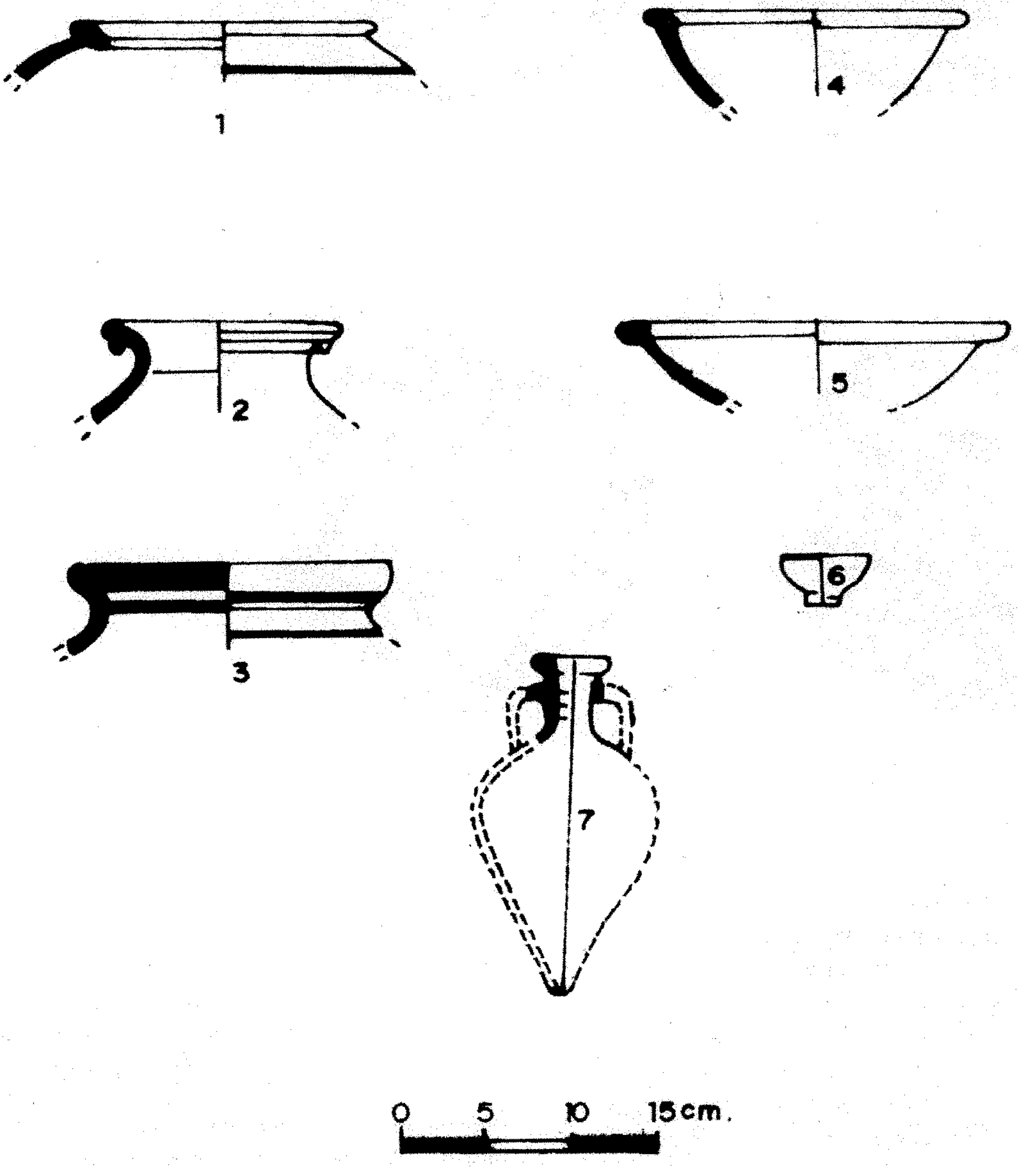

Fig. 10: Historical pottery from Bet Dwarka

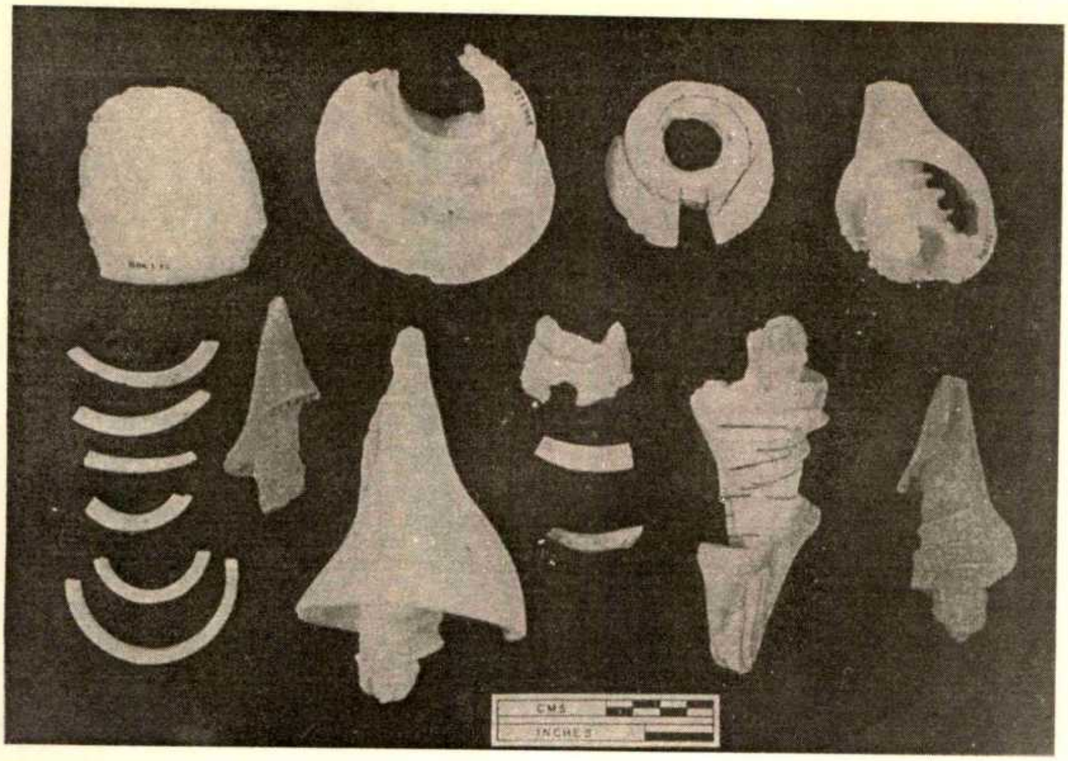

Fig. 11: Shell objects collected during onshore exploration

3. High-necked jar with a beaded rim having black bands on both the sides and some vertical lines also on the shoulder, well fired, coarse fabric. BDK-VI 85.
4. Bowl with nail headed rim, ill fired, medium fabric. BDK-II 85.
5. Convex sided bowl with a sharp rim and ring footed base, a depression on the base. BDK-II 85.
6. Deep dish with a beaded rim, well fired, medium fabric. BDK-II 85.
7. Amphora with straight sides and beaded rim, broken handle, well fired, medium fabric. BDK II-85.

Conch Shell Industry

The conch shell industry played a vital role in trade and commerce during the Harappan period. A large number of conch shell objects have been collected along with both the protohistoric as well as historical material, therefore, it is difficult to assign a date for the different shell bangles. However the exploitation of conch shell from the Harappan and historical periods is well established.

The shells collected from Bet Dwarka (Fig. 11) have been identified as *Cyprea ocellata* Linn, *Murex ramosus* Linn, *Murex virgeneus* Roding, *Babylonia epirata* Linn, and *Xanus (Turbinella) pyrum* Linn (Shirwaiker and Parulekar 1988: 133). The techniques adopted to manufacture bangles from the chonch shell is to extract the columella by sawing off a slice at the tip. These shells were possibly cut with the help of a toothed saw, the marks of which can be observed on the columella. A number of waste collumella can be seen with the saw marks.

Conclusion

The Harappans settled on Bet Dwarka island probably due to the availability of conch shells which have a commercial value. The discovery of a seal and Indus inscriptions indicate a habitation belonging to the early 2nd millennium B.C. The settlement on the southeastern side of the island was disturbed by wave action as can be seen from the cliff section facing the sea. Moreover a large quantity of pottery recovered from the intertidal zone supports the above inference. This evidence suggests that there was a rise in sea level, at least around Bet Dwarka, but it is difficult to determine the causes of sea level rise at this stage (studies on this aspects are going on at present). Later, the site was deserted for a long period and again reoccupied in the 3rd-4th century B.C. Amphorae suggest trade contacts with the Roman world at the beginning of the Christian Era. The location of Bet Dwarka was very favourable for safe anchorage in the past since it was protected from high waves and storms particularly from the southeastern side of the isalnd.

Acknowledgements

The authors thank the Director, NIO for permission to publish this paper. They thank Shri K.H. Vora, Scientist-in-Charge of Marine Archaeology Centre for his various suggestions, and Shri P. Gudigar and Dr. Sila Tripati for active cooperation in field work. The authors would also like to acknowledge the help rendered by Shri Karim Ali Shaikh and Shri S.B. Chitari.

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The Archaeological Significance of Beads and Pendants

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Abstract

The archaeological significance of beads and pendants is discussed from the point of view of the cognitive evolution of humans. Evidence is discussed for the presence of beads from the Acheulian period onwards and experimental manufacture of ostrich eggshell beads was undertaken.

Introduction

The connection between the cognitive evolution of humans and the topic of the production and use of beads and pendants during the Pleistocene may not be readily apparent, and yet such portable palaeoart objects can be much more illuminating than most other archaeological finds, at least in this respect. To demonstrate this, let us consider the present consensus model of cognitive evolution as held by mainstream archaeology. According to it there was a massive, explosion-like development with the advent of the Upper Palaeolithic in southwestern Europe, and this is attributed to the appearance of anatomically modern humans in the region. Prior to this significant change, Europe, the model predicts, was populated by primitive humans who probably lacked language, complex social structures and culture, who had no form of art, hunted inefficiently if at all, and may have even been carrion eaters who lacked the use of fire. They may have had no habitation structures and wandered over the landscape rather aimlessly, eking out a most precarious existence for hundreds of millennia in Pleistocene Europe as well as elsewhere.

It is always useful to exercise a great deal of scepticism in considering the mythologies archaeology creates about the human past. The discipline has a tendency of 'getting it wrong' most of the time, but in the case considered here it may have excelled itself. I propose to look at this dominant model of cognitive development very briefly, in the context of a series of finds from the time interval in question, and then to focus on a specific issue.

To begin with, the claims relating to the late appearance of symbolism, art and language (e.g. Chase and Dibble 1987; Davidson and Noble 1989; Noble and Davidson 1996) are attributable to the ignorance of those advocating these models. Ocean navigation and the ability to colonize new lands by sea clearly postulate the use of complex communication systems, and while this does not necessarily indicate uttered language, that would seem to be the most likely explanation. We should have known for several decades that ocean crossings by colonizing parties seem to have been successful more than 700,000 years ago (Verhoeven 1958; Maringer and Verhoeven 1970, 1977; Bednarik 1995a, 1997a), which implies that they were by *Homo erectus*. In compiling a list of finds that may indicate the use of palaeoart or complex technology I listed literally hundreds some years ago (Bednarik 1992a, 1994a, 1995b). Hominids of the Lower Palaeolithic not only created markings on portable objects of various types, they also produced the oldest petroglyphs we have found so far (Bednarik 1993a) and made extensive use of ochre or haematite. There is good evidence that they recognized iconicity (the property of an object to resemble another, which it can then stand for). A rudimentary ability of this kind even seems to have existed in the Tertiary, as suggested by the Makapansgat cobble (Bednarik 1996a). Lower Palaeolithic humans certainly used strings and therefore probably knots, they created well-made wooden artefacts and they produced composite weapons (fastening stone to wood). Since there are several cases of stone walls by them that have been interpreted as parts of dwelling structures (Bednarik 1993b) it may be a little hasty to assume that they lacked habitation shelters. They certainly produced artefacts from such materials as bone and ivory, they were capable of drilling or boring, and we assume that we have evidence of their appreciation of exotic finds, such as crystals and fossil casts, which we know they collected on occasion. It is also wrong to say that their lithic industries were unchanging: prismatic blades, borers and burins occur in Acheulian deposits, and in the Amudian of North Africa and the Levant, which developed from the region's Acheulian, blade tools become a major component of the industry (Rust 1950; McBurney 1967).

More relevant to the present paper are the origins of beads and pendants, which I have considered for many years. My interest in this subject is based on the following reasoning. Beads and pendants are in most cases fairly easy to recognize, they are rarely confused with other artefacts. But whatever purpose they are used for, it seems to relate to culturally complex practices.

Beads tell us a great deal about both the technology and the culture of their makers and users. Technologically they illustrate not only the ability to drill through brittle or very hard materials, but also they imply the use of cordage (Warner and Bednarik 1996). The very essence of a bead or pendant is to be threaded onto a string, it would simply be pointless to perforate a small object for another purpose but to pass a string though it. However, the use of string also suggests the use of knots, because a string needs to be closed to form a loop to be effective. Although the ends of a string may be joined by means other than a knot, e.g. by the use of adhesive or by plaiting, these alternative means are either impracticable or they are technologically even more complex than the use of knotting.

Without doubt such technological deductions beads permit us are of great interest, but of more importance are perhaps the cultural and cognitive deductions they make possible. Beads can be used in a number of ways or for several purposes: they may be emblemic, for instance, and provide various forms of information about the wearer and his or her status in society. Availability for marriage, political status, state of mourning might be such possible symbolic meanings. At one level one might believe that beads indicate simply body adornment (White 1993a, 1993b), but this is almost certainly an oversimplification. Even if vanity were the motivation for wearing such items, stating this explains not why such items are perceived as 'decorative'. The concept itself is anthropocentric, we do not assume that other animals perceive the information imparted by the beads as meaningful. In human culture, however, various forms of meanings may be encoded in such objects, as well as in other kinds of body adornment (tattoos, body painting, cicatrices, infibulation, anklets, armbands, etc.). In ethnography, beads sewn onto apparel or worn on necklaces may signify complex social, economic, ethnic, ideological, religious or emblemic meanings, all of which are only accessible to a participant of the culture in question. To name just one example: beads or pendants may function as charms, they may be a means of protection against evil spells or spirits. None of this information is archaeologically recoverable.

Irrespective of their cultural purpose, beads convey complex information about the wearer which it would be impossible to create a context for without the use of a communication system such as language. This needs to be emphasized because it leads to the postulate that the use of beads assumes the availability of a complex communication system. We have many other indicators of possible language use during the Lower and Middle Palaeolithic (e.g. other forms of symbolism or successful ocean navigation), and the very early use of beads and pendants provides similarly crucial evidence which, collectively, renders the hitherto dominant model of cognitive evolution completely superseded. We can no longer afford to ignore this kind of evidence (Bednarik 1995b), and in the case of beads this includes the oldest known pendants in the world, and the oldest known beads in the world. I will briefly describe the evidence I refer to and will then focus on the latter, and the production processes they involved, to illuminate their role in exploring the perception of their makers.

Early Pendants and Beads

Small perforated objects of the Pleistocene may have been beads or pendants, or they could have been quangings, pulling handles or buckles as reported ethnographically (e.g. Boas 1888: Figs. 15, 17, 121d; Nelson 1899: Pl. 17; Kroeber 1900: Fig. 8). However, most of the utilitarian objects of this type are not only of a quite typical shape or design, they exhibit specific wear traces and material properties. To be more specific, small circular objects with central perforation are considered to be beads, especially where they occur repeatedly. Similarly, objects such as animal teeth, perforated near one end (near the root) are not thought to be pulling handles, nor are objects that are too fragile to function as such utilitarian equipment.

Middle and Lower Palaeolithic finds with both artificial and natural perforations are quite common, and have been found since last century. Hundreds of such objects are reported in the literature, although there is often no reliable evidence that the perforation is anthropic (cf. Klíma 1991). Some materials can be perforated by natural processes. For instance, bones can be chewed through by animal canines or partially digested by stomach acids, while gastropod shells are commonly perforated by parasite organisms. It is therefore preferable to rely only on specimens bearing clear evidence of human work, but it is to be emphasized that the perforation of a bead or pendant certainly does not need to be man-made. On the contrary, naturally perforated objects are commonly used in ethnographic specimens and it seems likely that the earliest beads ever used had natural perforations.

The earliest possible beads of the Lower Palaeolithic were mentioned almost one and a half centuries ago, occurring together with the first Palaeolithic tools ever reported, and from the very type site of the Acheulian. In the famous paper by Prestwich (1859), in which he recognized the authenticity of the St. Acheul stone tools Jacques Boucher de Perthes had been collecting for many years, the occurrence of possible beads is also mentioned. These were found to be fossilized remains of a sponge, *Coscinopora globularis*, but Prestwich was not quite convinced about their human modification. However, he does concede that "Some specimens do certainly appear as though the hole had been enlarged and completed" (Prestwich 1859: 52). Be that as it may, circular, disc-like fossil casts have since been found at other Acheulian sites, such as the crinoid columnar segments (*Millericrinus* sp.) from Gesher Benot Ya'aqov, Israel (Goren-Inbar *et al.* 1991), and disc beads made from ostrich eggshell occur in the Acheulian of Libya (see below). The subject of Lower Palaeolithic beads therefore needs to be considered carefully.

The perhaps earliest objects with indisputably human-made perforations we know of are the two perforated pendants from the Repolusthöhle in Styria, Austria. If their age estimate is correct, they are close to 300,000 years old. One is a wolf incisor very expertly drilled near its root (Fig. 1). The second is a flaked bone point, roughly triangular and perforated near one corner (Fig. 2). Both objects were first mentioned by Mottl (1951) but have received little attention since then. They were excavated with a lithic industry variously described as Levalloisian, Tayacian and Clactonian, which is in fact an undifferentiated Lower or Middle Palaeolithic assemblage, but clearly free of Mousterian elements. The occupation deposit was found well below an Aurignacian level, separated from it by substantial clastic deposits of stadial periods. There is no reliable dating evidence available, the age estimate is based on the faunal remains, especially the phylogeny of the bear remains. However, it is broadly supported by the typology of the accompanying lithics, which is easiest to reconcile with a late Lower Palaeolithic industry.

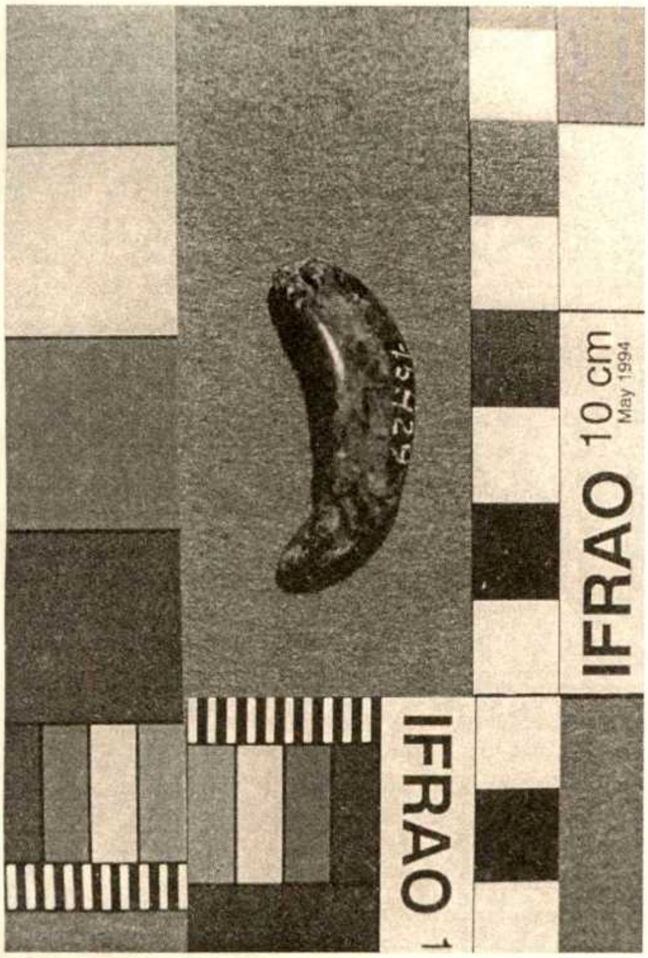

Fig. 1: Wolf incisor, perforated near its root. Undetermined late Lower Palaeolithic to early Middle Palaeolithic tradition, Repolusthöhle, Austria. Oldest known object of this type in the world

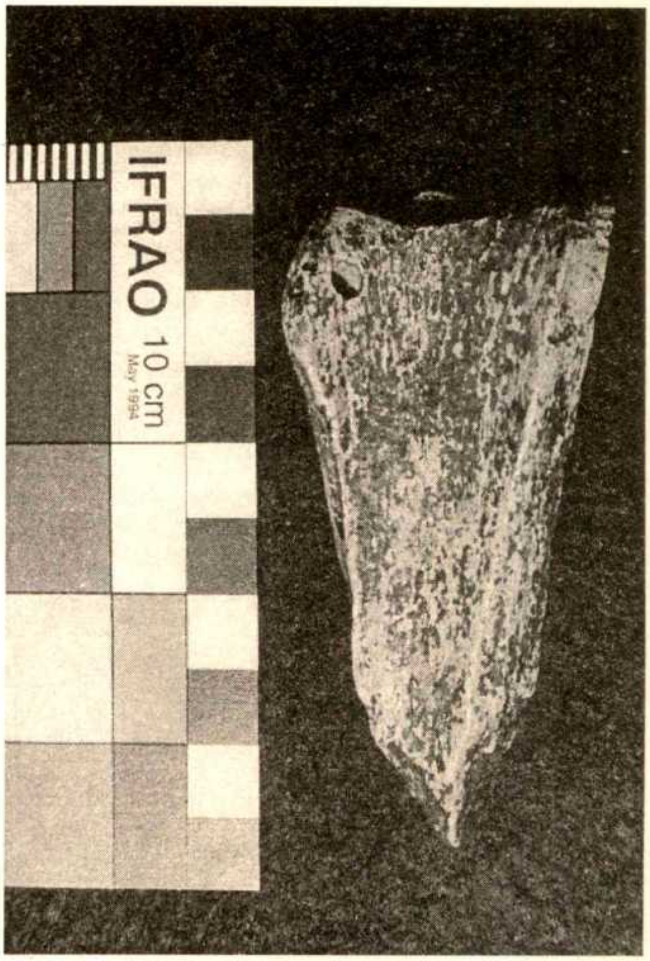

Fig. 2: Flaked bone point, perforated near one corner, excavated with the wolf incisor in Repolusthöhle depicted in Figure 1

Apart from the Acheulian ostrich eggshell beads reported below, there are no further reports of bead-like finds from the Lower Palaeolithic. It has long been known, however, that stone tools of that earliest period of human tool use were applied as borers or reamers, especially from micro-wear traces (Keeley 1977). The paucity of drilled objects is therefore probably attributable to a preference for softer materials to work with, especially wood. There can be no doubt that the Acheulian was a tool industry concerned primarily with wood working. Among the wooden implements or fragments of the Lower Palaeolithic are the seven objects from Schöningen, Germany (Bednarik 1996b), the spears and spear fragments from Bad Cannstatt (Wagner 1990), Bilzingsleben, Lehringen, Torralba (Howell 1966: 139) and Clacton-on-Sea, and the polished willow plank from Gesher Benot Ya'aqov, Israel (Belitzky *et al.* 1991).

There are numerous perforated objects also from the Lower/Middle Palaeolithic transition, and many of them may have served as beads or pendants. The Micoquian has yielded an artificially perforated wolf metapodium as well as a wolf vertebra from the Bocksteinschmiede, Germany (Marshack 1991). The Micoquian of Prolom 2, Crimea, produced no less than 111 perforated animal phalanges, besides four engraved palaeoart objects (Stepanchuk 1993). Although there is no proof that the phalanges were perforated by human hand, the fact that they are all of one species, *Saiga tatarica*, and that no perforated bones of other species were found in the cave, suggests that these may also be anthropic perforations.

The Mousterian of France has yielded a partly perforated fox canine and a perforated reindeer phalange from La Quina (Martin 1907-10), and another perforated bone fragment from Pech de l'Azé (Bordes 1969). In Spain, the same technological tradition has left us more perforated phalanges as well as a cranial fragment with a drilled hole at Lezetxiki (Baldeon 1993). The two perforated canines from Bacho Kiro, Bulgaria (Marshack 1991), too, are of the Middle Palaeolithic. As we approach the end of this technological phase, beads and pendants become increasingly common, and materials of stone are now drilled, first appearing in Russia and China. Thirteen such specimens from the lower occupation layer of Kostenki 17, found below a volcanic horizon thought to be about 38,000 years old, include not only polar fox canines and gastropod shells with perforations, but also stone and fossil cast objects (Bednarik 1995c: Fig. 4). From an intermediate Middle to Upper Palaeolithic site in China, Wenhua Shiyu, comes a broken stone pendant (Bednarik and You 1991), and the oldest beads found in Australia, from Mandu Mandu Creek rock-shelter, are about 32,000 years old (Morse 1993). That country's earliest known stone pendant is from the final Pleistocene of Devil's Lair, still belonging to a Middle Palaeolithic technology (Bednarik 1997b).

With the advent of the Upper Palaeolithic in Eurasia, beads become more numerous and are increasingly manufactured from unwieldy materials, especially ivory. Just three human inhumations at the Russian site Sungir', from a stone tool technology that is transitional between Middle and Upper Palaeolithic implement types, the Streletsian, contained more beads than have been found in the entire Pleistocene sites of the rest of the world. The three graves yielded 13,113 small ivory beads and over 250 perforated canine teeth of the polar fox. By this time, perhaps 28,000 years ago, the art of bead making had reached an extraordinary level, in which the results of thousands of hours of labour were lavished on three burials.

This synopsis of Pleistocene bead remains might convey the impression that beads were produced infrequently for 200,000 or 300,000 years, and then became much more numerous with the advent of the Upper Palaeolithic. While this is remotely possible it must be cautioned that this pattern of distribution in time provides a typical parabolic curve as demanded by taphonomic logic (Bednarik 1994b: Fig. 2). Accordingly the advent of the Upper Palaeolithic should *not* indicate the advent of frequent bead manufacture, but merely the *taphonomic threshold* of this phenomenon category. This is almost certainly the correct explanation of the evidence available to us, in which case that record must be tempered by taphonomic logic before it can be interpreted.

Ostrich Eggshell Beads of Pre-History

So far we have ignored one particular type of pre-Historic bead, the ostrich eggshell bead. To understand the significance of flat disc beads manufactured from this material, and their role in interpreting the cognitive evolution of humans, we need first to consider two factors: the distributions, in both time and space, of such finds, and the taphonomic explanation of both these distributions.

Disc beads such as those made from ostrich eggshell are a form of artefact that is not likely to have been made singly or in very small numbers. To provide such symbolic objects with a social meaning it would have been essential that they were made in quite large numbers, because it is repeated and 'structured' use which confers meaning on symbolic artefacts. The role of beads, as well as pendants, would have always been non-utilitarian, ideological, emblemic or symbolic. Moreover, very small beads such as those made from ivory or ostrich eggshell were probably not worn singly, because to achieve a decorative effect they are generally worn as sets in ethnographic specimens.

This renders it necessary to explain why — wherever ostrich eggshell beads have been found in Pleistocene contexts — only extremely small numbers were recovered. Moreover, why are the few known occurrences so extremely isolated in both time and space? Major intervening time spans have yielded no such artefacts, nor have vast geographic regions in which the ostrich is known to, or can be assumed to, have occurred. Taphonomic logic offers the most realistic explanation for this pattern (Bednarik 1986, 1992b, 1994b). Accordingly we are almost certainly dealing with a phenomenon of a very long *taphonomic lag time*. The extreme paucity of Pleistocene finds can readily be explained by postulating that they survived from beyond the *taphonomic threshold* of the phenomenon category in question (Bednarik 1994b: Fig. 2).

In India we have only a few specimens from the entire Palaeolithic (Bednarik 1993a, 1993c). Two are from Bhimbetka, south of Bhopal, and three from Patne, Maharashtra. Two of the latter are not perforated, although one is centrally scored. The Bhimbetka specimens were found in the neck region of an Upper Palaeolithic human burial (in shelter No. III A-28), so it has been suggested that they formed part of a necklace made up of beads of perishable materials. While the Patne specimens (Fig. 3c) range from 7 mm to about 10 mm diameter and are rather angular, those from Bhimbetka (Fig. 3a, b) measure about 6 and 7 mm respectively and are well rounded. In all, some forty-one Indian sites have yielded fragments of Pleistocene ostrich eggshell (Kumar *et al.* 1988). Radiocarbon dates ranging from about 39,000 to 25,000 years B.P. have been cited as relating to these finds. Of the 46 marked fragments I have examined, which are all those that have been found in India so far, 45 bear no anthropic decoration. They were marked by a natural process which I have described in detail, involving mycorrhyzal organisms, and which also affects other mineralized calcium carbonate-dominated substances of animal origin (ivory, limestone, bone; Bednarik 1992c, 1993c).

Other Asian regions producing ostrich eggshell beads are Siberia (Krasnyi Yar, Trans-Baykal), Inner Mongolia (Hutouliang) and the Gobi desert in northern China and Mongolia. In particular, an Epipalaeolithic or perhaps Mesolithic stone tool industry of the Gobi, usually named after the site of Shabarak-usu, has produced many disc beads, made of freshwater shells as well as ostrich eggshell (Narr 1966, 366). This tradition, typically of non-geometric microliths, is not dated but seems to precede the local Neolithic (Bednarik and You 1991). The ostrich (*Struthio camelus* sp.), now extinct in Asia, seems to have been widely distributed to the end of the Pleistocene and even into the Holocene. Depictions of it have been reported from the rock art of Inner Mongolia but their identification has been questioned (Bednarik and Li 1991; Tang 1993).

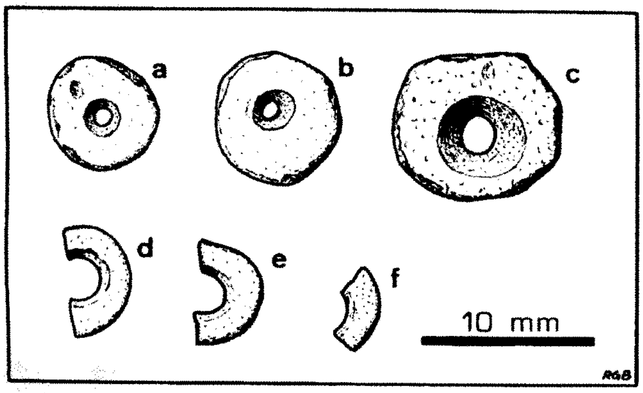

Fig. 3: Pleistocene beads made of ostrich eggshell, from India (a-c) and Libya (d-f): a, b - Bhimbetka III A-28, Upper Palaeolithic; c - Patne, Upper Palaeolithic; d, e, f - El Greifa site E, Late Acheulian

Both southern and northern Africa have produced finds of worked ostrich eggshell. The southern African sites yielding such finds date from the Middle Stone Age right up to the proto-Historic period. Decorated specimens from the Howieson's Poort phase in Apollo 11 Cave, Namibia (Wendt 1974), may well be 70,000-80,000 years old, even older. This site has also produced beads made of eggshell from a layer thought to be 22,000 years old. Diepkloof Cave in the southwestern Cape, South Africa, has yielded about a dozen supposedly decorated ostrich eggshell fragments of the Middle Stone Age (Beaumont 1992; Bednarik 1993d). Ostrich eggshell beads from Bushman Shelter near Ohrigstad, Transvaal, have been suggested to date from somewhere between 12,000 and 47,000 years ago (Kumar *et al.* 1990). Such beads still occur in much more recent periods in southern Africa. For instance they are found in the Smithfield B, a tool complex of the African subcontinent's interior regions of the 14th to 17th centuries (Hirschberg 1966). The use of ostrich eggshell for a variety of purposes, including the production of disc beads and as water vessels, continued to be practised by the Bushmen of southern Africa until recent times, and has been described ethnographically (e.g. Forde 1934).

In the far north of Africa, where the ostrich has been extinct for millennia, two pre-Historic periods have provided evidence of the past use of ostrich eggshell: the Capsian and the Acheulian. The Capsian is an Epipalaeolithic blade and burin industry in northern Algeria and Tunisia, dating from the first half of the Holocene. It includes not only numerous figurative and non-figurative engravings on ostrich eggshell fragments (Camps-Fabrer 1966), but also beads of snail shells, teeth and small stones (Camps-Fabrer 1975: 280-2). Almost any excavation of major Capsian deposits produces ostrich eggshell beads, usually well rounded with central perforation. Containers of wholly preserved ostrich eggshells, too, have been recovered from the Capsian. The decoration they bear suggests that the engraved fragments found in the Capsian deposits may well be from such containers. Saharan rock art depictions convincingly resembling the ostrich are known and may well be of the mid-Holocene. Examples are from Wadi Tilizahren (Jelínek 1985a: Figs 4, 6, 31, 34, 55, 56; 1985b: Figs 5, 28) and Wadi Mathendous, Fezzan (Striedter 1984: Fig. 7); Tzeretegem, Niger (Striedter 1984: Fig. 187); Iheren, Tassili-n-Ajjer (Striedter 1984: Fig. 125); and North Thyout, Atlas (Muzzolini 1995: Fig. 200).

Of very considerably greater age than the Capsian are the three fragments of disc beads from a major Libyan occupation site of the Acheulian (Ziegert 1995). Also made from ostrich eggshell, they closely resemble those from other regions and later periods. These first Acheulian ostrich eggshell beads ever reported (Fig. 3d-f) come from the El Greifa site complex (Wadi el Adjal, near Ubari). The site is located on what was a peninsula of the huge Fezzan Lake of the Pleistocene, which then occupied a large part of southwestern Libya, measuring about 200,000 km^2. Its former extent is indicated by freshwater limestone expanses across the Murzuq Basin, overlying sandstone beds of up to 3000 m thickness (Thiedig 1995) that are still charged with freshwater of between 9000 and 24,000 years age, i.e. deposited during the wetter climate of the late Würm. El Greifa provides ample evidence of Early (Mindel), Middle and Late Acheulian (Riss) occupations, followed by Aterian (last Interglacial) deposits. Dating of sediments from 320,000 years to the end of the Pleistocene has been attempted by uranium/thorium analysis at the Niedersächsisches Landesamt für Bodenforschung, Hannover, but it is considered to be tentative and experimental. The significantly fluctuating lake levels also provide chronological data; for instance they were about 60 m higher in the Middle Acheulian than in the Lower.

The alkaline and calcareous sediments have provided excellent preservation conditions for insect remains, seeds, bone and ostrich eggshell fragments. The remains of what appears to be a round semi-permanent dwelling structure, about 180,000 years old, have been found on the former lake shore. There is ample evidence of quarrying of quartzite, and substantial ash beds indicate that the reed belt was annually burnt for a period of many millennia. The sites' lithic inventory includes generally 'handaxes', scrapers, borers and burins, but is dominated by large Acheulian types.

The favourable conditions also led to the preservation of three ostrich eggshell beads from the Late Acheulian of El Greifa site E. Dated by the U/Th isotopes of the calcareous sediments they are from, they appear to be in the order of 200,000 years old. The near-perfect rounded circumference and perforation (Fig. 3d-f) of the El Greifa ostrich eggshell beads demonstrate that even hominids of the Acheulian possessed a well-developed technology of working this fragile medium with the greatest possible confidence and skill. These perfectly made artefacts also imply the existence of the social structures necessary to provide an ideological context for the production and use of complex body decoration. The three beads are preserved as fragments only (c. 58%, 54% and 28% preserved respectively), but they share a similar perforation diameter of about 1.7 mm, and even their external diameter is very consistent (5.8-6.2 mm). This consistency in size and the near-perfect rounding of all preserved edges, internal and external, suggests the use of a standardized manufacturing process, a characteristic these beads seem to share with the much later beads of the Upper Palaeolithic as well as those of various cultural traditions of the Holocene.

Replicating Ostrich Eggshell Beads

The immediate purpose of my experimental replication work between 1990 and 1996 was to determine the technological processes involved in the production of beads of, and engravings on, ostrich eggshell. The results relating to engravings have been reported (e.g. Bednarik 1992c), here I will summarize my findings relating to beads, and their implications in terms of the cultural context of their production.

Kumar has conducted experimental replication work with heavily weathered ostrich eggshell fragments collected from Chandresal, which are in the order of 36,000-39,000 years old (Kumar *et al.* 1990: 36). He used Mesolithic stone tools to produce the perforations of two experimental beads, which each took him 10 to 12 minutes to drill through, working from both sides. In my own replication work I have always used fresh ostrich eggshell, because that is what was presumably used in the distant past, and I applied freshly made stone tools of different types and materials to establish relative suitability (Bednarik 1991, 1992c, 1993c). I found it difficult to economically drill through the unweathered shell using thin pointed tools of cryptocrystalline sedimentary silica. The most effective tools for this purpose were found to be rather coarse-grained quartzites and quartz. With them I initially reported drilling through the shell of a complete ostrich egg in times ranging from 70 to 90 seconds, i.e. working from just one side (Bednarik 1991).

I have subsequently found it easy to reconstruct the production processes for these beads. The raw material is of unusually consistent properties: the shell thickness is uniform, as is the three-layered morphology of the shell (described in admirable detail by Sahni *et al.* 1990). The only significant material variable is attributable to the shell's curvature, which is of a much smaller radius at the ends of the egg than it is along the sides. My replication work soon established that the manufacture procedure used followed a specific pattern, as demanded by the morphology and dimensions of the end product, work traces and the nature of the available stone implements. For instance I found that it was difficult and uneconomical to first shape the bead and then drill it, and that it was marginally easier to drill from the concave side than from the convex. Thus experimentation succeeded in reconstructing the work process quite convincingly, which it seems was as follows.

Once drained of its contents, an ostrich egg was dried and broken into fragments. These were then reduced further, into polygonal pieces of about 1-2 cm² area. This was done by carefully breaking the shell between fingers, probing for already existing fracture lines (Fig. 4). The small fragments were then drilled individually, which is a little more difficult than drilling into the complete egg. An experienced operator takes between 70 and 145 seconds (average 121 secs, n = 11) to perforate the dry shell from one side. (I consider that I became an 'experienced operator' after attempting to produce 25 or 30 beads, and quantitative production details reported here refer to subsequent work.) No significant differences in drilling time were noted according to direction (from outside or inside), but the outer veneer (< 0.1 mm; Sahni *et al.* 1990) is somewhat harder to start from, and is of course of convex surface, so I came to prefer the concave mammilary innermost layer (Sahni *et al.* 1990: Fig. 2) to start drilling from. Contrary to various opinions stated, I do not believe that ostrich eggshell beads were usually drilled from both directions, as it is very difficult to meet up with the centre of the first opposite indentation. It is much easier to ream out the opening once the boring tool breaks through, using the point of a thin prismatic sliver of chert. I propose that this is the way ostrich eggshell beads were customarily perforated.

I also drilled shell fragments soaked in water for 24 hours, taking from 80 to 140 seconds (average 118 secs, n = 11), which suggests that this does not affect workability of the shell. The principal variable in drilling time is clearly the quality of the stone tool point, and this can vary considerably. In my replicative work I used a variety of stone tool materials, including cryptocrystalline flint, microcrystalline cherts of various types, chalcedony, coarse and fine quartzites and quartz crystal. I also tried out a variety of tool morphologies, finding that thin points became blunt very quickly, as did finely-grained materials. Nevertheless, all materials I used necessitated the application of two or more points to produce a single perforation economically, so the time of making or resharpening borers has to be added to production time. Stout angular points on flakes or blades of 1-2 mm thickness at their end were found to be the most effective, and excessive pressure is counterproductive as it accelerates the wear of the tool point exponentially.

Once the perforation is complete it is reamed out from the other (convex or outer) side, using slender bladelets or prismatic points, which may be quite fragile. The duration of this process depends on the desired hole diameter, but in about one minute an even diameter of around 2 mm, eliminating much of the drilling cone, can be attained (Fig. 4). It is clear from my work that the three perforated beads of the Indian Upper Palaeolithic were reamed out by alternating rotation of the borer: this usually results in a slightly oblong perforation, as already noted by Semenov (1964: 78) in drilling through other materials with stone tools.

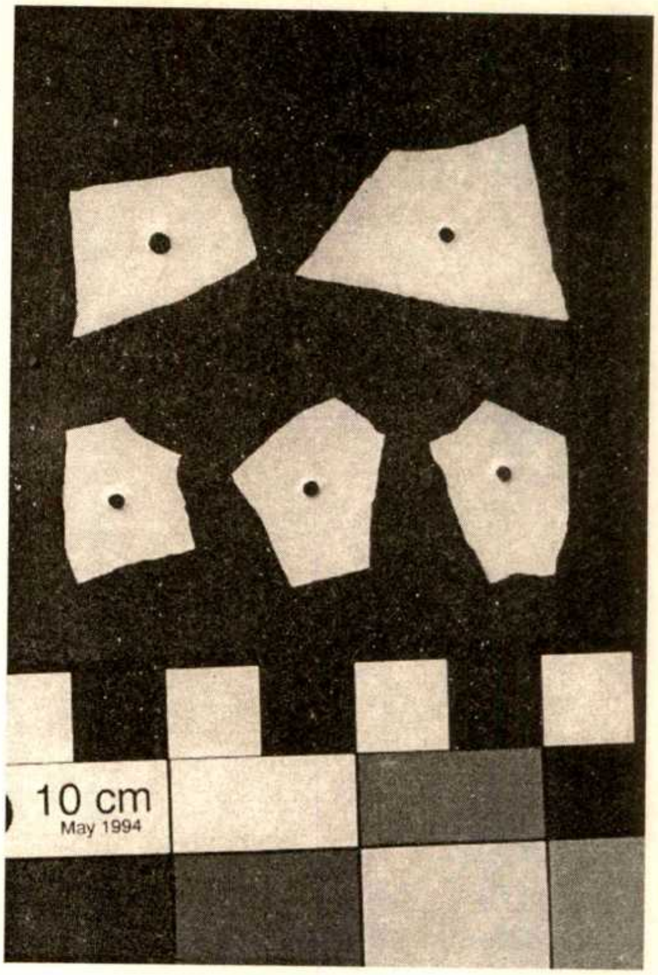

Fig. 4: Drilled replicative bead roughs before trimming, made from fragments of modern ostrich eggshell (of *Struthio camelus*)

Before commencing the abrading of the still angular fragment, the excess area is trimmed off by gripping the piece firmly between two fingers in the area that is to form the final bead, and pressing its convex side against a stone surface. This process of snapping off small angular fragments until the actual bead blank is obtained (Fig. 5) requires skill and judgment: if the bead is incorrectly held or handled, it can easily crack through the perforation. The average time of the trimming process is 34 seconds.

Grinding the excess material from the fragment's edge is easy, although very demanding on the operator's finger tips. I found it convenient to divide this process into two steps, first grinding the bead blank into a roughly circular shape of under 10 mm, resembling the Patne specimen in Figure 3. This requires between 65 and 270

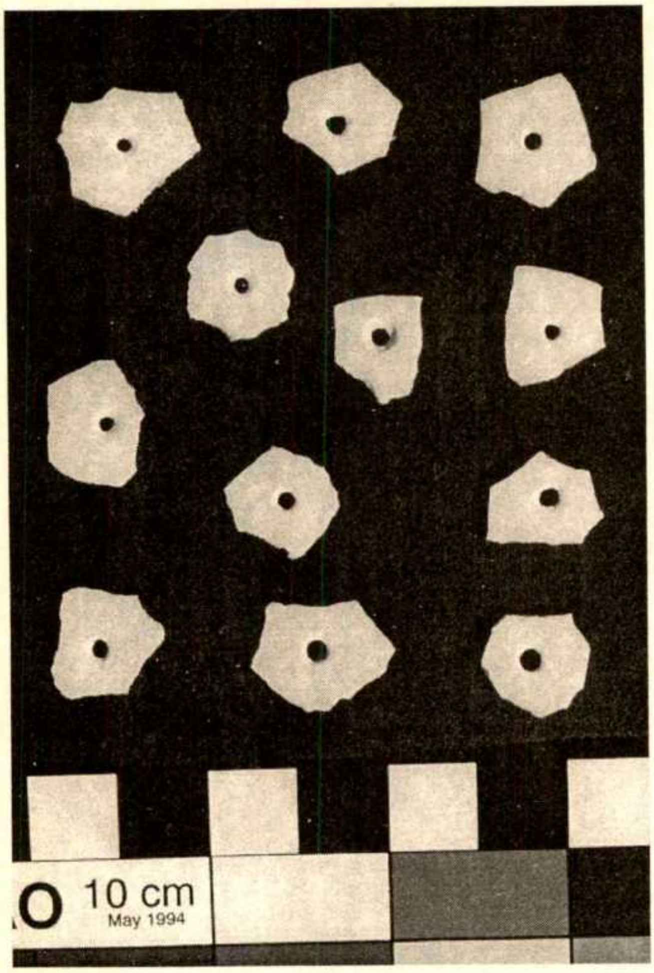

Fig. 5: Bead roughs after trimming

seconds (mean 217 secs, n = 12), the duration being related directly to the amount of excess material to be removed. Siliceous sandstone, silcrete or quartzite provide excellent grinding surfaces, and an experienced craftsman should not break any pieces in this process (Fig. 6).

In attempting to replicate the Acheulian specimens from El Greifa, I found that I had to further refine the product of the last step. It takes between 580 and 645 seconds to reduce the <10 mm beads to almost perfectly round specimens of about 6 mm diameter (mean 618 secs, n = 12). On this basis we can estimate that the time it took to produce one of the El Greifa ostrich eggshell beads, assuming that the maker was a skilled craftsman, was in the order of 17 minutes, or about 25 minutes if we include the time of preparing and resharpening stone points (Fig. 7).

Both the beads and the stone tools used in their manufacture were examined under a stereoscopic optical microscope at low to medium magnifications. The information so gained is not only useful in the microscopic study of pre-Historic bead specimens and stone borers, it also explained the surprisingly rapid blunting I experienced with the stone tools. Expecting to find significant microscopic spalling on working edges, I was surprised to see that the 'blunting' of borers was not so much due to wear, but due to clogging up of recesses with highly compacted calcium carbonate. Nevertheless, a characteristic type of wear sheen was also noted on the edges at the point of many tools.

The ground and powdered eggshell material was also examined carefully, and was found to contain surprisingly large chips of eggshell layer, commonly measuring 0.1-0.5 mm, but in rare cases of up to 1.8 mm length. However, over half the volume of the white powder is of much smaller grain size, most of it 2-20 m. Differences in its composition were noted according to the rock type used: a gritty siliceous sandstone and a silcrete produced slightly different cumulative grain size distribution curves than a dense central Indian quartzite.

Discussion

The replication of archaeological specimens is part of experimental archaeology, without which interpretation in this discipline is of very limited use. It is through the experimentation with technologies that we gain credible insights into how materials must have been utilized to produce the kind of record the archaeologist encounters. In this sense experimental archaeology is related to the study of the taphonomy of archaeological remains, and together these two areas of research can bring archaeological interpretation to life. I will try to illustrate this with the presently considered evidence.

The most important deductions we can draw from the present study concern the three Acheulian beads from Libya, and what we can learn about the circumstances of their manufacture, in terms of illuminating the conceptual world of their makers. The first observation we can make concerns the considerably finer workmanship of these Acheulian specimens in comparison to those we have of the Upper Palaeolithic (cf. Fig. 3). This may be unexpected, but it mirrors an experience we had recently with European rock art: the most sophisticated we have found so far, that of Chauvet Cave in France (Chauvet *et al.* 1995) turned out to be also the earliest we know of in the European Upper Palaeolithic (Clottes *et al.* 1995). Hence the idea of evolution towards increased sophistication is a Eurocentric myth in rock art development, and may well be so in other areas of archaeology.

The near-perfect roundness of the Acheulian beads can be obtained only by constant checking of the shape during the final abrading process, using not just a developed sense of symmetry, but possessing a very clear concept of a perfect geometric form. This roundness cannot be the result

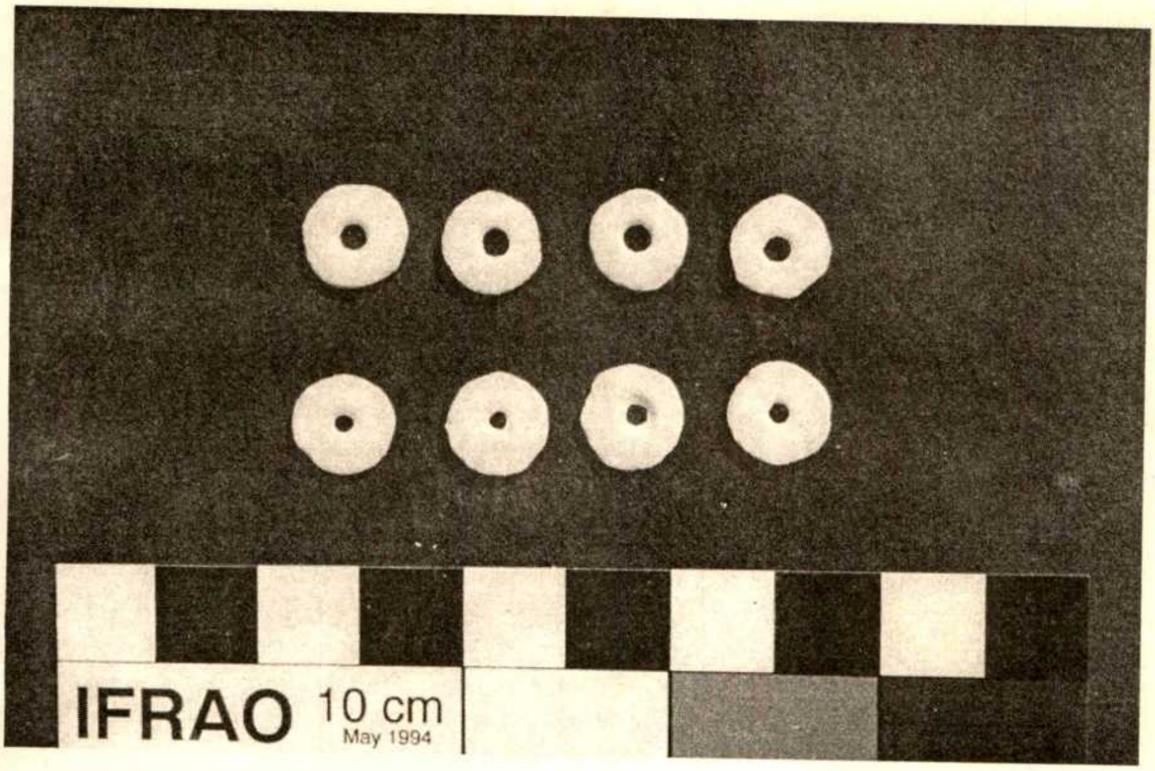

Fig. 6: Finished replicative ostrich eggshell beads of just under 10 mm diameter, matching those found archaeologically

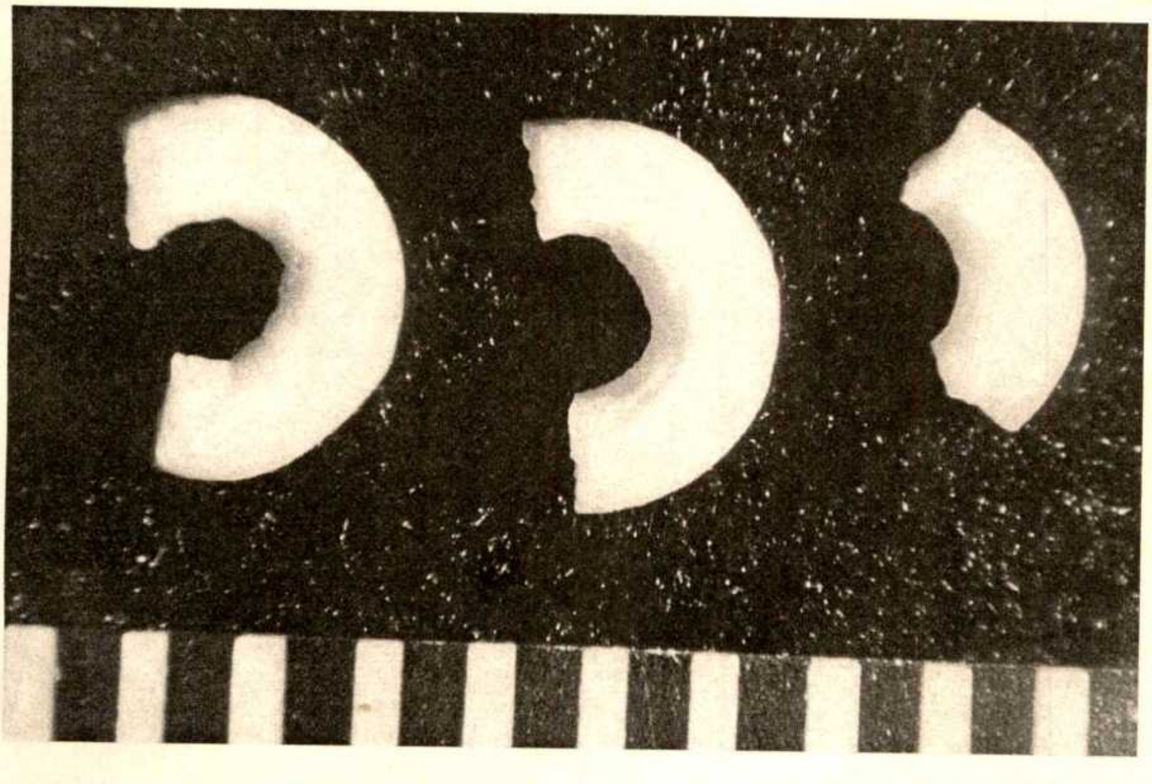

Fig. 7: Replicas of the Acheulian ostrich eggshell beads from El Greifa site E, Libya. Using Acheulian stone tool types, these beads take an experienced operator about 25 minutes each to produce

of chance or some 'instinct' driven by a mere desire to reduce the size of the beads. It is the outcome of a very clear abstract construct of form — a concept-mediated, geometrically perfect form. Moreover, it is the result of a determined effort to produce high-quality work. To extract the full potential information offered by these few beads, I find the following point particularly important, and it also demonstrates vividly the enormous benefits of replication studies.

During my experiments I found that as the beads are ground to a diameter of 8 or 7 mm it becomes increasingly difficult to hold them while grinding them, and after a time it becomes a rather painful task. The finger tips not only have to maintain a tight grip, they are also subjected to abrasion from the siliceous stone. About 6 mm is the diameter at which it becomes uneconomical to continue reduction further, and this is precisely the size of all three Acheulian bead fragments we have. This, too, is not a coincidence, but the result of a deliberate decision to reduce the beads to the smallest realistically possible size. It must be considered also that at sizes of under 6 mm, the beads become increasingly fragile: with a perforation of almost 2 mm, their rim width falls to under 2 mm. Moreover, because of what remains of the bi-conical perforation profile, the innermost part of the rim is never of full eggshell thickness. I found that if the beads were ground to a smaller size, they would become susceptible to fracture, either during manufacture or during subsequent use.

So we have two limits on minimum size imposed by practical considerations, and we need to ask: why did the makers of these beads push their technology to its practical limits? After all, a larger bead is much easier to see, yet a smaller bead represents a significantly greater effort. This observation coincides with the already mentioned geometric perfection of the form, which is most certainly deliberate. The most parsimonious explanation for both the size and the form of these objects is that these characteristics reflect a highly developed abstract value system and a considerable social complexity in the society that made and used these beads. Without a cultural impetus placing value and meaning on such perfect forms, and on an utmost standard of craftsmanship that pushes the technology available to it to the utmost limit, it seems simply impossible to account for the empirical characteristics of the evidence. There is certainly no utilitarian explanation to account for them, so the motivation of these artisans is to be found in ideology.

The strong hypothesis that humans of the Late Acheulian period, about 200,000 years ago, possessed such a cultural system is at massive odds with the currently dominant paradigm. Not only does it postulate a value system concerning purely abstract criteria, there must have been a socially shared and communicated meaning regarding the significance of the characteristics of these symbolic products. There can be no purpose in producing technological perfection if there is no comprehension and appreciation of its ideals.

Another insight provided by the replication of Acheulian ostrich eggshell beads (Fig. 7) concerns their technological perfection. It suggests that their makers drew from the experience of a long tradition of manufacturing such products of which we know almost nothing. We do know that perforation of hard objects (e.g. teeth) was probably already practised earlier, and very competently. Bearing in mind that most ethnographically known beads are of perishable materials, we may reasonably assume that this also applied in the distant past. Naturally perforated small objects may have been used as beads, such as crinoid columnar segments (Goren-Inbar *et al.* 1991) or the earbone of the cave bear (Marshack 1991: Fig. 6). Finally, but perhaps most importantly, taphonomic logic demands a much earlier commencement of the use of beads than can be detected on the fossil record (Bednarik 1994b).

The excellent rounding of the circumferential edge of the Acheulian beads and the even width of the ring indicate a conscious appreciation of an essentially abstract, geometric form by 200,000 B.P. at the latest, an appreciation which is amply evident from the later Middle Palaeolithic technological traditions. The latter period has provided such evidence from Hungary (the Tata nummulite; Bednarik 1992a: Fig. 4) to Australia (the extensive geometric rock art of that country's Pleistocene tradition, which is the world's most recent Middle Palaeolithic).

Mainstream archaeologists may find such evidence of early sophistication extraordinary, but seen in the context of other finds of the general period in question it should be neither unexpected nor controversial (Bednarik 1995b, 1996c). The question to ask is: why, for instance, are orthodox archaeologists still speculating whether language was possible prior to 35,000 B.P. (Davidson and Noble 1989) or 60,000 B.P. (Noble and Davidson 1996)? They are unaware that even *Homo erectus* must have had language to navigate the sea and colonize new islands (Maringer and Verhoeven 1970, 1977; Bednarik 1995a, 1997a). They may be unaware that petroglyphs, too, were produced in the Acheulian, that haematite or other iron compounds were used as pigment up to 900 millennia ago (Bednarik 1994a), that hafted tools with wooden handles, stone-walled dwellings and portable engravings date from the Lower Palaeolithic (Bednarik 1992a, 1995b, 1996d), and that the oldest beads or pendants we know about may be close to 300 millennia old (Bednarik 1992a). It is unfortunate that the dominant models in archaeology, since the time of the rejection of the Altamira art a century ago, remain largely determined by scholars who are unfamiliar with the relevant evidence. The most urgent task in archaeology is to introduce a systematic study of the limitations of knowledge of its practitioners '... concerning existing data... how language barriers and other biases limited the flow of information in this field, or how false constructs... flourished in archaeology' (Bednarik 1995d: 120). This should be done as one of the several strategies of introducing metamorphology (*op. cit.*), the scientific version of archaeology. The example illustrated in the present paper confirms this need for major reappraisal.

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Back to the Bones?

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Abstract

This paper expresses doubts about the need to investigate the biological origins/affinities of the authors of ancient civilizations, and the way in which it is being done. It also expresses misgivings about recent work which implies that biological characteristics tell us about the history of language.

Are Victorian preoccupations with broad and long skull types a thing of the past, or are they back with us in a new *avatar*?

Prehistoric and contemporary skeletal features, blood-group frequencies, and molecular (mtDNA in particular) frequencies — as biologically inherited phenomena — are being compared, used for classifying people into groups, and mapped worldwide, in order to trace the 'peopling' of diverse regions. It is reasoned that the closer the biological similarity between two groups, the more recent is their common ancestry, and vice versa. Further, the greater the mtDNA diversity in a region, the older are the common ancestors, for there has been greater time for changes to occur. Change and 'replacement' are also detected in regions. Thus L.L. Cavalli-Sforza, the geneticist and co-author of *History and Geography of Human Genes* (1994), suggests that the population of northern America had a certain number of genetic (population) inflows at particular periods. He equates these with the migrations of languages.

Linguists do not all accept these conclusions (see Bateman *et al.* 1990: 4-8; Trask 1996: 386-8, 401-2). The most obvious sort of refutation (D.F. Armstrong commenting on Bateman *et al.* 1990: 13) is the observation that the people of Ethiopia are genetically African but share a language with groups who are biologically Caucasians. Cavalli-Sforza's genetic trees do not, linguists argue, translate as easily into linguistic family trees as he claims. Moreover, it could not be assumed that the only migrations that occurred, into Europe or India, were migrations of people who brought Indo-European, or Indo-European and Dravidian, languages into those regions. It is also known that populations with unconnected histories can share gene-frequency patterns, and that variation is not caused only by migration and intermarriage: there is also mutation (one allele changes to another), and variation caused by sheer chance (genetic drift caused by random non-genetic factors).

In South Asia the old skull-type studies of length and breadth and bizygomatic breadth of modern people still linger (see Majumder *et al.* 1990) and there is also a sophisticated stream, pioneered by K.A.R. Kennedy, investigating malnutrition and disease amongst prehistoric populations, through a range of skeletal features and with accurate measuring devices and procedures for error correction. Here, however, I discuss another kind of research represented by three recent papers, in two of which Kennedy is the author/a co-author. Even though this is not my area of specialization, I discuss this work because certain important questions have arisen.

The first of these papers is 'Biological Adaptations and Affinities of Bronze Age Harappans' by B.E. Hemphill, J.R. Lukacs and K.A.R. Kennedy (1991). (I do not discuss the first part of the paper, on adaptation, diet, and pathology.) The question is asked, 'Who were the Harappans?' and the answer is sought in physical terms: biological (craniodental) affinities with other populations, ancient and modern. Does such a question have intellectual validity? From what I can make out, specialists on the subject hold that all human groups have biologically fuzzy boundaries and that there are no separate lines/lineages of heredity — instead, groups merge, interbreed, and split; that 'all characteristics that vary systematically between human populations also vary within them' (M.H. Wolpoff and T.L. Crummett in their comment on Lieberman 1995: 186). Even if this were not so, and 'the Harappan' population were found to be 'pure' and wholly endogamous, what point is served by pin-pointing its biological identity? Could that make us any the wiser about Harappan economy or institutions, technological development, or urban life?

A brief sentence in the 1991 paper of Hemphill *et al.* (p. 139) informs us that only those traits of teeth and skull have been studied that are inherited (not the outcome of adaptation or trauma or dietary change or muscle development). There is no discussion on this point. A lay person like myself takes it that 'nasio-prosthion height', 'bizygomatic breadth' and 'bifrontotemporale breadth' are skull features we can acquire only from our parents, even though it appears that inheritance patterns are far from obvious (Dahlberg and Grabner 1976) and that the difficulties of separating adaptive from inherited variations remain — this in fact being one reason why race as a scientific category is so problematic.

The craniodental evidence utilized by Hemphill *et al.* comprises craniometry and non-metric cranial and dental data. As regards the first, 14 craniometric traits were studied out of a possible 30, for reasons such as availability. Of 27 possible non-metric features of the cranium, the study utilized 18. For dentition it was 10 out of 20 aspects of the crown. We take it on trust that 14 (18) (10) variables together are as significant as 30 (27) (20). Again, in the absence of explanation, we take it that each of the 14/18/10 studied features varies independently of the others.

These traits have been put to cluster analysis, divergence distance measures and principal-component analysis, all described in a thick mesh of jargon. For example 'Arscine transformed trait frequencies were standardized to have a zero mean and unit variance prior to submission to principal components analysis. Unrotated principle [sic] components were used since varimax rotation served to reduce the percentage of the total variance explained by the first three principal components... Factor score coefficients (eigenvector coefficients) for each variable were multiplied...'. (p. 143).

Archaeologists like myself who find this double-Dutch will tend to read only the conclusions, ignoring the methods; and this would lead to uncritical acceptance of a "scientific" paper. We also need to think whether an analysis in the framework of one discipline can afford to omit caveats, explanations, starting assumptions or alternate methods/conclusions, when addressed to practitioners of another discipline.

The craniometric analysis shows Mature Harappans of Harappa town to be biologically closest to the Late Harappans of Cemetery H and to people at Timargarha in Swat. (The skeletons of Mohenjo-daro are different from all of these.) It is interesting that B.B. Lal closes his book "The Earliest Civilization of South Asia" (1997), by citing this finding, viz. absence of genetic disruption after the Harappan period, as a pointer to the weakness of the theory of Aryan origins outside India. Let us at this stage consider the database for Hemphill *et al.*'s conclusions.

For craniometric analysis 80 individuals from Harappa and Mohenjo-daro represent an entire civilization, one which had spread over Kathiawad-Kachchh-Sind-Punjab and had a 500-600 year duration; 28 skulls the Late Harappan, and 20, Timargarha. These are by no means the statistician's random samples. True, in archaeology we must make do with the paltry evidence we find: but is it legitimate to make it the basis of a mathematical exercise? Each group of skulls from a site is treated by these scholars as a population, an entity, whose statistical parameters are worked out.

Second, this analysis is concerned with grouping inherited physical features. It is a reasonable assumption — but only that — that these groups of skulls from different archaeological sites represent 'populations' or aggregates of individuals who reproduced among themselves. Consider, for example, Wheeler's remarks (1947: 87-88) on burial 5 at Harappa Cemetery R 37. He suggested that this burial of an 18-25 year old woman, with its wooden coffin and reed mat shroud, appeared more Sumerian than Harappan [perhaps the grave of the foreign wife of a Harappan trader]. In *Harappa Excavations 1986-1990* (R. Medow 1991: 195) the excavators of Harappa report, three more graves with traces of coffins. In fact in a study of the Royal Cemetery at Ur (Pollock 1991) it emerges that this graveyard could not have contained the remains of all residents; moreover, and more important (see also the comment of P.R.S. Moorey p. 184, on Pollock 1991), the Royal Cemetery may not even have been a representative sample: too many people were absent. Other cemeteries, intramural burial and river immersion would also have existed. So also post-cremation interments in jars at Mohenjo-daro and Harappa indicate that burial in cemeteries was not the only mode of disposal of the dead.

On the other side of the breeding population coin is the argument that even if R 37 was a graveyard for all residents of Harappa, the total population of this 150-ha city would have been too large for everyone to have been eligible to marry any other resident More probably there were smaller 'breeding isolates' or marriage circles, within the various ethnic groups and social strata.

Third, the skulls analysed in 'Biological Adaptations' for craniometry are not only non-random samples, they come from Egypt, Iran and South Asia and date between 7000 B. C. and A. D. 1950 (p. 145). The 20 skulls from Timargarha date '1400-800 B.C.'. Is this last group a fit entity for population statistics?

In the analysis of dental features, study collections from Late Harappa and Mohenjo-daro — used in the craniometric analysis — are *absent*. The results show that closest to the Harappans were people of early chalcolithic (4500 B.C.) Mehrgarh (sample sizes N=33 and N=25 respectively). But the latter have no close affinities to the earlier population of neolithic Mehrgarh (6000 B.C.), which instead is more similar to that of Inamgaon (1600-700 B.C.). Note that neither Mehrgarh nor Inamgaon figure in the craniometric analysis, just as Late Harappa and Mohenjo-daro are represented there but not in the analysis of dentition. How do the three sets of analysis corroborate one another (see p. 173) when they utilize different finds from different sets of sites?

After remarking on the discontinuity in dental features between neolithic and chalcolithic Mehrgarh (p. 173) the authors say this 'fits well with recent glottochronological studies which place the entrance of Dravidian languages into South Asia around the 4th millennium B.C.' They have leapt from inherited physical characteristics to language, which is not biologically inherited, and can be acquired (or shed) by a person in a lifetime. Individuals and groups all over the world speak more than one language (Bateman *et al.* 1990: 5-8) (Note that dentition of groups outside South Asia is not part of the dental non-metric analysis.)

* * * *

Let us stay with language and biology. In "Have Aryans been Identified in the Prehistoric Skeletal Record from South Asia?" (Kennedy 1995) K.A.R. Kennedy jokes about having failed to find the skeleton of an Aryan. He condemns the old anthropology that ascribed particular skull shapes to the Aryan or any other 'race'. He then recapitulates the findings of the 1991 paper we have discussed above. "Our multivariate approach does not define the biological identity of an ancient Aryan population", he says (p. 49) — but what about the Dravidian reference made in that paper?

Further, the point of the rest of Kennedy's 1995 paper is not clear. It appears to me that he *does* treat "Vedic Aryans" as an entity to be sought biologically, and as he cannot find their bones, it appears he doubts not the linkage but Aryanness itself. He reports at length an argument of Schaffer questioning the existence of Aryan migration, and one of G. Erdosy claiming a South Asian origin of Aryans. Kennedy ends by repeating that biological patterns do not conform to linguistic or cultural patterns.

Perhaps confusion arose because of an assumption that invasion or mass migration was the only possible vehicle for the advent of Vedic Sanskrit in India. These imply in their turn a single event, destruction, and large-scale killing. [So deep is the confusion that Shaffer (1993: 53) imagines that there are 'early Vedic accounts of an Indo-Aryan invasion into South Asia'!] No linguist says this is the only possible mode of language replacement, and we will return to this point below.

* * * *

Kennedy's jokes about Aryan skulls under the pavement at Flora Fountain did not prevent B.E. Hemphill (co-author of the 1991 paper), A. Christensen and S.I. Mustafakulov (1997) from entitling their paper (an extension of the 1991 analysis) 'Trade or Travel: An Assessment of Interpopulational Dynamics among Bronze Age *Indo-Aryan* Populations' [emphasis mine].

Here the database is extended to include material from a few Central Asian sites, dating from 2100 B.C. It is claimed that dating from the earlier findings, being confirmed, were 'statistically robust and biologically meaningful' (p. 858). Once again 'biological discontinuity' after neolithic Mehrgarh is associated with the posited origin of Dravidian languages in Western Asia. No caution is exercised in the shift from biological to linguistic connections, when it is well known that these are not coterminous phenomena. Again the material for analysis is spread wide, geographically and chronologically. Not only is the population of Timargarha (1400-800 B.C.) in northernmost Pakistan intermediate between Harappans and Sarai Khola (200-100 B.C.), it is also intermediate between neolithic Mehrgarh (6000-4000 B.C., Kacchi Plain) and Inamgaon (1600-700 B.C., Maharashtra). In craniometric features Timargarha, 1400-800 B.C., is "exactly intermediate between Tepe Hissar II and Tepe Hissar III." Tepe Hissar lies in northeastern Iran, and the transition between its levels II and III lies well before 2000 B.C. It is stated in the context of the Aryan controversy that results do not show 'massive population movements and replacements.'

Let it be repeated that major demographic change is not a necessary condition for language change (in our case local languages giving way to Vedic Sanskrit). Language replacement has occurred 'countless times' in history (Trask 1996: 324). In Mesopotamia Akkadian replaced Sumerian in the later third millennium B.C. without leaving a hiatus/series of destruction levels/change in material culture. Anatolian archaeologists made futile attempts to recover archaeological evidence for the replacement of Hattic by Hittite in the second millennium B.C. While Turkish gradually became the predominant language there from A.D. 1100 onwards, Trask notes (1996: 323 ff.), the population of Anatolia remained physically akin to that of Greece and the Levant even though the source of the Turkish language was Central Asia. In Ireland too the gradual shift from Irish to English was not triggered by any 'massive population movement or replacement': the reasons were political and economic.

* * * *

It is often bilingualism rather than migration which is the prelude to language replacement (consider the current shift from Punjabi to Urdu in Pakistan and to Hindi in India in some social circles). Suppose A and B languages are spoken in a region and, when their speakers are together, they converse in A because it is the language of the rulers/ prestige/advanced technology/economic opportunity. It will happen that on more and more occasions, native speakers of B will speak A among themselves. Language B is gradually reduced to restricted usage, say in the home or in domestic ritual and younger generations of B-speakers gradually become more proficient in A than B.

M.M. Deshpande (1995) draws a lucid picture of ancient replacement in South Asia. There is ample evidence (loan words from Munda and Dravidian) that Indo-Aryan speakers were in contact with speakers of other languages. It is also evident that the earliest bilingual people were local Dravidian speakers, who, in the course of generations of oral transmission, introduced retroflexion onto the language of the *Rgveda*.

The biological anthropologists could have given more thought to trade, which they suggest was a likely conduit for genetic flow. Hemphill *et al.* (1997: 861-862) speak of a 'vast trading network' in Iran in the fourth millennium B.C. Veracity aside, trade does not necessarily mean large numbers of people on the move, partly because in the prehistoric period trading was not the same thing as it is today. Kohl (1989: 229) for example remarks that the critical mercantile role of the Portuguese in the sixteenth century A.D. was hardly reflected by the actual number of Portuguese abroad!

Thomas (1993: 1-2) refers to the ready acceptance among archaeologists of scientific conclusions, largely because of lack of knowledge of the relevant science. Let two instances suffice for our purposes. In 1977 Joan Oates *et al.* concluded that Ubaid pottery found at many places on the Gulf littoral had (with a few exceptions) been made in the Ur region of southern Mesopotamia. The basis of this conclusion was Neutron Activation Analysis of 115 potsherds, and petrographic study of 74 sherds and 3 soil samples (10 archaeological sites were involved).

The Ur origin of Gulf Ubaid pottery became an unquestioned truth for archaeologists like myself until Roaf and Galbraith (1994) found errors in the data tabulation and modelling and found that the measures of difference between any Gulf sherd and the group of 21 sherds from Ur had to be reworked. The homogeneity of the Ur pottery was itself a problem. What then emerged was that the Gulf pottery *could* have come from southern Mesopotamia, nothing more.

Thomas (1993: 2) also says that there must be real problems to which sophisticated techniques are brought. Consider the complex statistical analysis in Welsch *et al.* (1992) and Roberts *et al.* (1995) around material culture items recovered early in this century from coastal villages in New Guinea. Some 6000 artefacts, of 47 categories, were counted, and their presence/absence at the villages noted. The object was to verify whether artefactual similarity between villages was a function of geographic proximity or linguistic affinity. The two teams came to different conclusions. No wonder, for one of the collectors of the artefacts was a curio dealer, the others an ethnologist and a museum curator. As P. Bellwood, commenting on Roberts *et al.* (p. 776) said, such studies of material culture distributions are meaningless outside the context of inter-village exchange, inter-marriage and bilingualism. R. Dunnell, in his comment Roberts *et al.* asked (pp. 777-8) whether the artefact collections at all represent meaningfull entities. It appears that complex techniques had been applied to questions that lack intellectual substance.

Through the nineteenth century the British colonial administration and its intellectuals perceived essential connections between race, physical attributes, and culture, and culture as inhering in physical type. This preoccupation with physical types peaked when social reform movements, demands for factory legislation, etc. also spread (personal communication, Meena Radhakrishna) and threatened the status quo of colonial society. Radhakrishna, in her research, concluded that the early anthropology was part of a regressive reaction to social change. She asks (personal communication) why such preoccupation is again perceptible in the West, at the close of the twentieth century. I do not have the answer(s); perhaps the political context is the end of the American dream of the melting pot. Perhaps it is the advent of new kinds of consciousness of origins and identities.

Whatever the answer, my misgivings about this kind of science remain. First, prehistoric residence groups, which were probably communities, have been interpreted as if community is race (without the component of colour). Barkan has shown (1992) that even when scientists repudiated the notion of race as a scientific entity in the 1930s, racism did not die. In my view, seeking Harappan origins (in the 1991 paper) and BMAC origins (in the 1997 paper) in biological terms *is* racist, even if notions of superiority/inferiority are left unstated. It appears as if these scholars view biology as the essence of identity. In that case, will biology (rather than technological systems or social institutions or political domination) become an explanation for behaviour, as it did in the nineteenth century?

I would appreciate a response from Hemphill and his associates, explaining to us the desirability of this kind of research.

Acknowledgements

It was extremely useful to discuss this issue with Nasir Tyabji and Meena Radhakrishna, visiting scholars at the

IIAS. Aditi Mukherjee, Fellow, IIAS, and author of studies on language replacement, helped me sort out the difference between race and community, race and language. Romila Thapar shares my concern and discussed the issues with me, while Julian Reade played devil's advocate.

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Pottery Manufacturing Techniques: the Role of Technical Constraints and Personal Choices

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Abstract

Archaeologists tend to conceptualise the prehistoric potter as a person whose output is conditioned by the physical, chemical and economic constraints in which he worked. This paper argues that, while these factors all play a part, it is his wider social environment that plays a major role in shaping his output. Rather than nature, it is culture that accounts for different textures, colours and forms, and for the choices that are made at each stage of production. This argument is illustrated using data from two pottery producing centres in Kachchh. Implications from the ethnographic study for interpreting the archaeological record are discussed.

Introduction

The ubiquity of pottery in archaeological sites makes it one of the most useful kinds of data on chronology, site-to-site relationships, ritual and dietary practices, economic relationships of production and exchange, and many other aspects of cultural behaviour.

Harappan pottery enjoys a pre-eminent position in research in this field (Hegde *et al.* 1985, 1988, 1992; Joshi 1972; Possehl and Raval 1989; Rao 1963, 1979, 1985). It is evident from the excavation reports of Harappan sites that archaeologists group vessel sherds into types according to the presence or absence of certain stylistic features with the resulting categories allowing sherds to be used to determine chronological sequencing of sites or inter-regional contacts (e.g. Bhan 1992; Rao 1985; Manchanda 1972; Joshi 1972).

Some of the questions relating to variation in the ceramic assemblage might be answered by closer knowledge of manufacturing techniques. A description of potters' technical processes advances archaeological studies beyond typologies, towards an explanation of the phenomena which are observed (van As 1984), and of the individuals who created and used ceramic artefacts. Ethnographic studies (Mackay 1930; Sharma 1965; Rye and Evans 1976; Roux 1989; Saraswati and Behara 1986) are useful in understanding the pottery manufacturing process and its relation to the past; but the tendency to focus almost exclusively on the pot (an exception to this is Miller 1985) results in a neglect of the social and cultural contexts in which that pot is manufactured, distributed, used and eventually discarded.

Archaeologists conceptualise the prehistoric potter as a person whose output is conditioned by the physical, chemical and economic constraints in which he worked. This overlooks the fact that, as an integrated part of the wider social system, a potter makes choices that are conditioned by social needs. But, if "any behaviour is acquired in social circumstances and technical behaviour is no exception" (van der Leeuw 1993: 239- 240) then, the decisions a potter makes in the process of executing a single pot depend not only on his resources and technical expertise, but also on his wider social environment.

This paper examines choices governing the output of contemporary potters in two manufacturing centres of Kachchh, an area that has had a long tradition of decorated pottery (Saraswati 1978), perhaps even dating back to the Harappan period. The centres are located in the villages of Lodai and Gundiyali, and are among the most significant suppliers of pottery to Kachchh and beyond. Lodai supplies a small and highly specialised local market, notably of pastoral nomads. Gundiyali has a long tradition of supplying pottery not only to Kachchh, but also beyond this, to Mumbai and even overseas. Twenty six potters and twenty four painters were interviewed during field work.

No direct equivalence is claimed between modern conditions and those inferred from the archaeological record, but this paper argues that the study of choices governing modern technical behaviour can assist in refining the interpretation of the excavated archaeological material (Rye and Evans 1976)

Vessels

In both villages potters manufacture cooking and non-cooking vessels. These comprise pots for water carrying and storage, pots for dry storage (grain, etc.), pots for buttermilk, plates. There are also vessels for boiling, frying, and preparing food, special festival artefacts, and ritual vessels. These vessels are manufactured using both wheel-made and hand-made techniques. Figure 1 gives examples from each category of vessel manufactured in both areas.

Resources

Any potter requires ready access to clay and other raw materials such as temper, colour, fuel and water. Potters in the centres studied lived roughly within a 5 km radius of their supply of clay. In Gundiyali, potters use both red and black clay. Lodai potters use only red clay, but for cooking vessels mix in *bundho* (red clay mixed with a high proportion of sand). In both areas, potters mix donkey dung with clay to increase workability in hand-made pottery. Donkey dung - unlike cow dung - does not make a vessel smell, and it is readily available as potters have their own donkeys.

In Gundiyali, red clay is extracted from a mine some 5-6 km from the village, lying between the village and the sea. Black clay is extracted from a river bed some 3 km away. In Lodai also, the sources of red clay and *bundho* lie only 1 km from the village. Red clay is extracted from the *dungar* (mound) and *bundho* from the river.

As resources have become exhausted, potters have slowly shifted their mining activities, but typically a potter does not search out or experiment with other sources. For example, Gundiyali potter Ali Daud explained: "It is a traditional clay source, and it is good clay" (personal communication, 1993). Indeed, this is considered self-explanatory by potters from Lodai, "My father used it, so I use it" (personal communication, 1993).

In Gundiyali during the winter months (November-February) potters mine in teams, taking out red clay to a depth of as much as 3 m. In Lodai potters do not need to dig such deep mines, since the usable second layer is found closer to the surface at a depth of only 0.60 m. Here potters do not work in teams but go out once a week or according to requirement. Black clay in Gundiyali is collected from the river bed while at Lodai, *bundho* is collected from the river bank.

Modification of the raw red clay follows a similar procedure in both areas. Mined clay is spread out to dry in the courtyard and large lumps are crushed, usually by women and/or children who work as apprentices. Smaller lumps are sieved (0.5 cm aperture) and the powder is arranged in a circle. Lumps are placed in large pots or a trough in the ground and mixed with water to produce a thick liquid. This liquid is passed through the sieve again as it is poured into the centre of the powder ring and the two are mixed to form a pliable substance. The clay water and clay mixture are then kept in a large broken pot or a pit in the ground. In Gundiyali the sieved liquid is added to the raw red clay to neutralise the salt contained in it which the potters believe causes breakage.

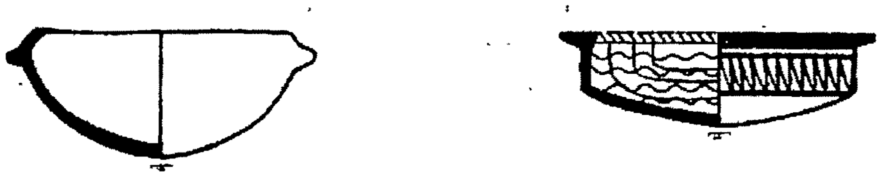
Proportions of materials depend on the type of pots manufactured. In Gundiyali, non-cooking vessels use red and black clay only, while wheel-made vessels for cooking require a combination of red clay, black clay and the addition of heat resistant sand. Hand-made vessels are not used for cooking; if they are small, they are made of red clay and donkey dung; if large, black clay is added to the mixture to give them the required workability (Fig. 2).

In Lodai only red clay is used for wheel-made non-cooking vessels. Potters believe the that quality of the clay is so good that it does not require any modification for vessels that will not be exposed to heat. For cooking vessels, the body is made from red clay and the base contains red clay and *bundho*; red clay alone on the base would shatter but the temper allows for greater resistance to heat. For the hand-made non-cooking vessels, donkey dung and red clay are used. According to the potters this provides the correct workability for hand-made vessels. For cooking vessels, *bundho* is added to the mixture to enhance its heat resistance (Fig. 3).

This mixing of materials according to the type of vessel to be produced can be likened to a cooking recipe, which potters know and adapt to suit their own needs. Vessels that are exposed to heat, such as cooking vessels, have greater functional constraints than other types, however, since they must meet certain technological standards (de Boer 1984).

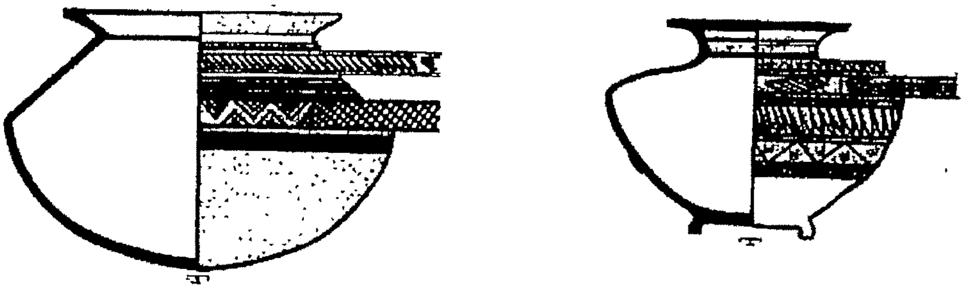
In general, potters no longer mine their own colours, which are required in small quantities, but purchase them from a trader, as the distance to the source can be as much as 90 km. Potters in Gundiyali prefer Nagarcho *geru* (ochre coloured clay) which is considered pure, and gives the best lustre. Lodai potters used *geru* from Khavda. White colour is available locally Gundiyali potters obtain black colour from Adisar at a distance of 220 km, and for the Lodai potters, black colour is brought from Virani area, 60 km away.

The preferred fuel for the kiln is *thor*, which is slow burning and allows the temperature to rise evenly. *Acacia* burns very fast but in Gundiyali *thor* is no longer available. Fuel in both the areas is a combination of either



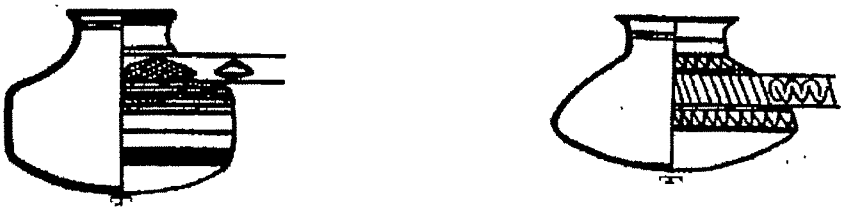
Cooking Vessel : Gundiyari

Cooking Vessel : Lodai



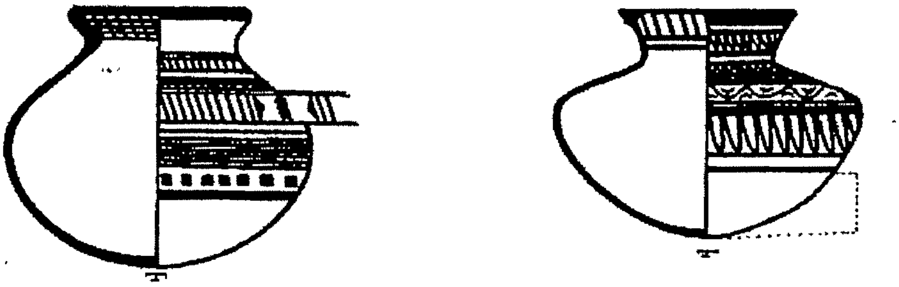
Storage Vessel : Gundiyari

Storage Vessel : Lodai



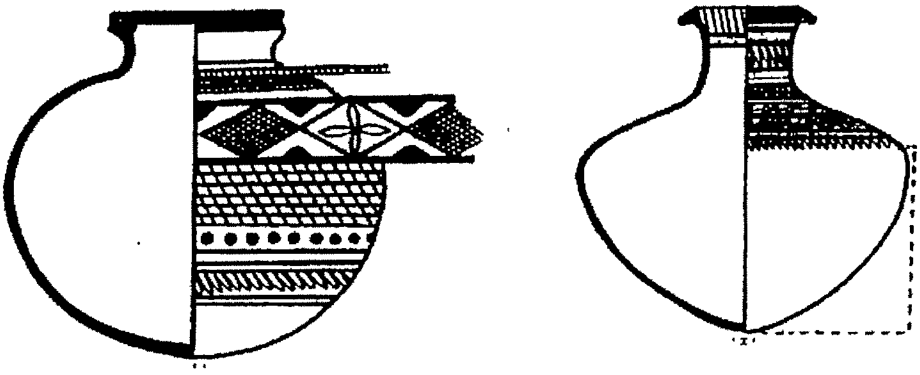
Buttermilk Vessel : Gundiyari

Buttermilk Vessel : Lodai



Buttermilk Vessel : Gundiyari

Buttermilk Vessel : Lodai



Water Vessel : Gundiyari

Water Vessel : Lodai

Fig. 1: Categories of vessel manufactured in Gundiyali and Lodai

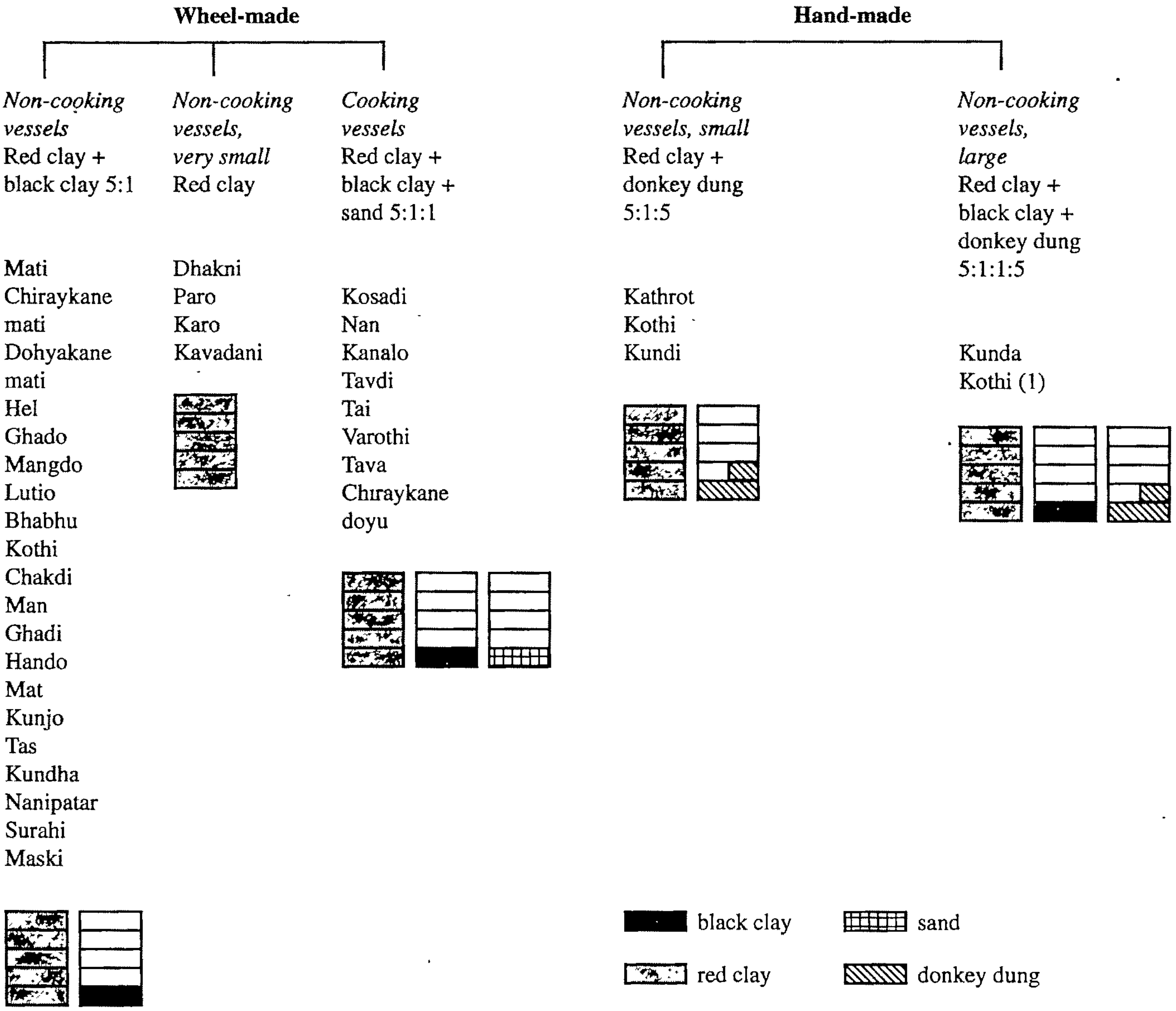


Fig. 2: Gundiyali. manufacturing techniques and proportions of raw materials

acacia or *thor*, grass or dry waste (stalks, chaff, etc.), and cow dung.

Manufacturing Techniques

Once assembled, the materials are mixed by hand. First the powdered clay is placed in a small heap and a depression is made in the middle into which clay water is sieved and the material from the sides gradually incorporated. The mass is kneaded by hand to distribute the moisture evenly and eliminate any air pockets or lumps of foreign matter or clay which may later cause breakage. It is then wedged and covered and left to age for 4-6 hours. Although potters in both areas know that longer storage enhances the quality of the clay, this is now rarely done.

Lodai and Gundiyali use the same variety of manufacturing techniques. Small pots, lamps, etc. are made solely on the wheel; *tavdi, kothi, kunda,* etc. are among the hand-made vessels; all other vessels are made using compound techniques. All potters use a stone wheel though some also have the more modern wooden wheel which was not available to their grandfathers.

Clay prepared in the morning is used in the evening. Women prepare *tankra* (small lumps) whose size depends on the size of the pot to be made. Since the pot is later beaten and enlarged, the rim, which remains unchanged, is the only definition at this stage of the type of the pot that will eventually be made: it is an important identity mark,

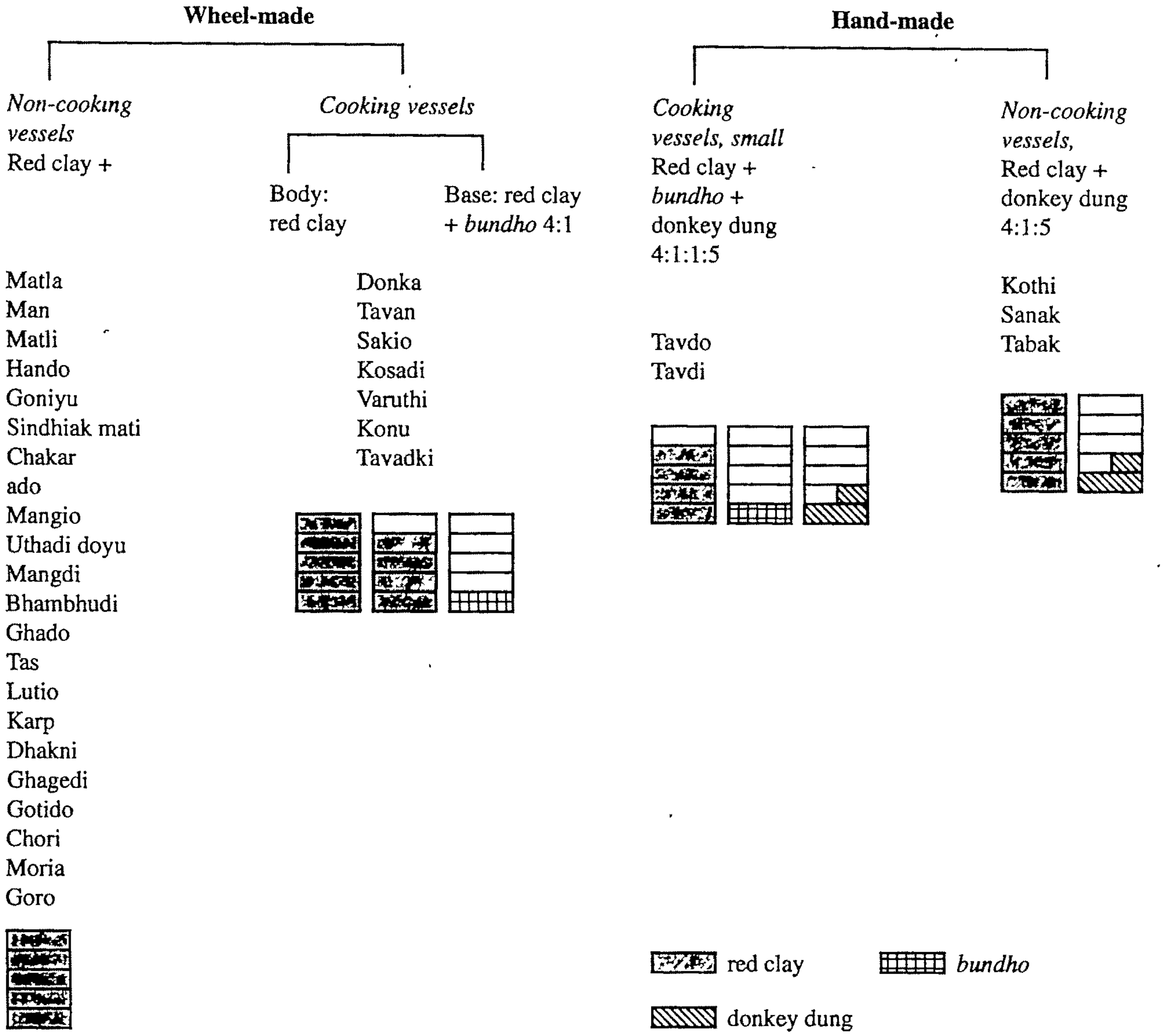


Fig. 3: Lodai: manufacturing techniques and proportions of raw materials

and potters claim to be able to recognise their product from the rim alone.

The potter first places a *tankra* on the wheel and once the wheel has gained momentum, he centres the clay and opens it with his thumb, raising it to the required height and executing perfectly the rim, which will remain unchanged. Walls are left at different thicknesses, according to the amount to be beaten for a pot to achieve its final shape and thickness. During the process water is added as required to keep the clay malleable. With the wheel still spinning, the pot is removed by hand and lifted to the place where it is left to dry. The average length of time a pot remains on the wheel is 2-3 minutes, depending on the size of the pot and its rim. In Gundiyali a potter makes 40-50 pots at one time; in Lodai, the number is 20-30. The number of pots depends in part on the health, age and capacity of the potter. In addition, in Lodai, the potters report that clay is hard to beat and develops cracks very fast so it must be worked slowly.

Since two types of clay are used in combination in Lodai for cooking pots, *bundho* at the base and red clay for the upper body, potters use two *tankra* at once. The *bundho tankra* is placed on the wheel and red clay *tankra* put on top of it. As the potter draws up the pot, the two meet but each holds its correct position, with the *bundho* at the base.

For small vessels and toys, a very large *tankra* is centred on the wheel and several items thrown in succession from the clay at the top of the lump. Such items, for easy handling are placed on a wooden board to dry.

Drying takes place in a shady, open area for up to an hour and pots are then moved indoors or are covered where they are with thick cloth, depending on the weather. Too much moisture or wind makes pots crack and potters, where possible, protect their vessels from such consequences.

Beating, which enlarges the pot and gives further cohesion to its clay wall (Saraswati 1978), takes place in the morning, when the pot is leather-hard. This takes place between two and four times depending on the size of the pot, the weather and the type of clay. After each beating, the vessel is left to regain its leather hard characteristics. The interval between the successive beatings also depends on the size of the pot, and the weather conditions.

In both regions, pots are enlarged using a range of different-sized stone anvils and two varieties of wooden paddles, also of different sizes Large concave paddles are used to give the pot its basic shape and smaller flat ones the final shaping.

Sitting cross-legged with the pot placed on a gunny bag or woollen cloth in his lap, the potter smooths the thick base to remove any impurities. The pot is beaten using a circular movement from the base upwards with a stone anvil held inside the pot, against which the potter beats the clay with the paddle. In Gundiyali ash from the kiln or home is sieved and sprinkled onto the pot as it is beaten, to absorb the moisture exuding from the beaten clay and to stop it from sticking to the paddle. In Lodai *bundho* serves the same purpose.

The body of the pot is first given the basic carinations so that it takes on a shape, after which it is left to dry on the *kantha* (inverted broken pot shoulders). The base is shaped last. After that, in Gundiyali, a shaped pot is left on the *kantha* and a small, fired pot is placed over the rim of the pot being made. A sharp jerk is delivered, so the air pressure inside the pot blows it out into a perfect shape. In Lodai, pots are not blown into shape. Once the rim is dry, and hard enough to bear the pot's weight, the pot is inverted to dry its base.

After beating, a thin layer of wet clay applied with a cloth smoothening the surface and filling any small cracks. A potter may also use the small wooden paddle or just his hands to make the pot smooth. If a pot breaks during the manufacturing process, potters employ two different techniques for mending it. For simple repairs while beating, if a lump or impurity is found to make the vessel crack, the potter removes the hard clay or impurity and beats the lips of the resulting hole until it is closed, adding additional clay if required. More complicated repairing is needed if there is a crack at a junction or the joint. In this case the potter uses a finely ground paste made of paper which has been soaked overnight and mixed with donkey dung. Water is applied to the pot so cracks are visible: the area surrounding them is roughened with a knife and the paste applied and smoothed. Such repairs are scarcely visible once the slip has been applied.

Hand-made pots are made by women, using a mould or slab technique. A mould (*karab*), resembling a rough, thick plate in appearance, is used to make the *tavdi.* Ash is sprinkled on the mould to prevent sticking, then clay is pressed into it and beaten to the desired thickness with a stone anvil, adding ash to prevent sticking as necessary. In this process the clay gradually reaches the rim, which is formed by hand, using a cloth which has been wetted with a clay/water mixture. If a handle is required this is also fashioned at this stage. Once the clay has shrunk it is removed from the mould and left to dry. In Lodai, Kachchhi *tavdis* are decorated by incision, which today is done by running the wheel taken from toy vehicles along the rim. Earlier it was done with a stick, shell or similar implement.

Using a depression in the ground or a slab in the courtyard, the flat-bottomed *kathrod, kunda, sanak, tabak*, etc. are made by forming a beaten, circular clay base onto which is placed a slab of clay. The slab is then pressed onto the base from inside and outside, and beaten to the required thickness, again using ash. The rim is formed in the same way as for a *tavdi.*

Very large *kothis* are made by forming the initial circular base in the same way, and adding layers of clay slabs that have been patted flat and joined to the base or to the preceding layer. Once it has dried to leather hardness, each layer is beaten — by a male — to the required thickness, using a paddle and anvil. One layer is added per day and five to ten *kothis* are made at one time, in a five to seven day process. The number of layers depends on the size of the intended pot, and varies from three to seven The rim is incised by applying finger pressure.

Production in both villages varies seasonally, e.g. water vessels are in demand during the summer, buttermilk pots in winter. Vessels for pastoral customers are made and sold during the monsoon, when they return from migration. Rates of production are lower in the summer, when the heat dries the surface too rapidly; in winter the wall dries evenly throughout. One Gundiyali potter estimated that he could manufacture 30-40 *mat* (water pots) per day in winter, a rate that drops to only 15-16 during the summer. Pots manufactured in summer are not as well shaped, nor of such good quality. Traders often store water vessels made in the winter for sale in the summer.

Decoration

In both areas all decoration is done by women. In Gundiyali the division of the pot into registers is done with painted lines by men on the wheel while, in Lodai this division is done by women, and not on the wheel.

The surface of a completed pot is enhanced by the application of slip, added when the pot has completely dried. In both villages pots are usually red slipped, but this may vary with a specific function such as ritual or ceremonial pots. Before application, the slip (*geru* or white) is placed in a pot with water so that lumps dissolve and it becomes fine-grained. The thickness of the mixture depends on the painter's preference for ease of application and depth of colour. Black, used for painting, is prepared by grinding nodules of colour between a stone and a rough surface until it is so fine that it could be applied like kohl to your eyes (Sarabai, personal communication 1993). A pink colour is produced by a light application of white slip after the pot is fired so that the original red colour of the clay mixes with the slip and results in a pink colour. Orange colour is achieved by a light application of *geru.*

A piece of cloth is dipped in the slip and applied to the vessel which is rotated by hand as it rests on a pivot, such as an old pot or a metal vessel. Within a couple of minutes the colour has dried and the vessel is then burnished with a woollen cloth or, as more recently used in Gundiyali only, a piece of plastic gunny bag.

Painting is done on the dried, burnished and slipped surface of the pot, using a white or black colour applied by brushes of varying thicknesses, made of bamboo or date palm cut into 15-20 cm strips, the last 5 cm beaten so the fibres splay out. It takes from between 5 to 30 minutes to paint a vessel, depending on its size, the speed of the painter and the elaborateness of the design.

Drying and Firing

Drying times and locations need to be carefully monitored before firing as mistakes at the drying stage can lead to flaws which can destroy vessels either during drying or firing (Rice 1987). Wind can cause violent temperature fluctuations that spoil the process, and potters can do little to save a load apart from closing the mouth of the kiln if the wind changes during the firing. Potters prefer to begin firing in the evening, and as winds are stiller in the winter, this is the preferred season for firing.

In Lodai and Gundiyali, newly formed vessels are left in the sun for 30 minutes once they are beaten or completed. They are moved into the shade or indoors until the quantity required to fill the kiln has been made. Vessels are then sun dried for a minimum of four hours to ensure that all moisture has evaporated before firing. At this stage, in Lodai, potters rusticate pot bases by applying a thick mixture of water and clay. Rustication makes pots sturdier and easier to handle, and also provides a roughened surface on which pastoralists can apply the mixture of cow dung and clay which they believe enhances the capacity of a pot to remain cool.

Potters in both areas fire vessels by open firing, using triangular kilns which are sited in a special fixed area. In both areas the kiln is on a slope, high at the back. In Gundiyali the kiln is surrounded by a wall of ash 90 cm thick and 30 cm high, on which broken sherds used for closing the kiln are kept. Behind that wall a ditch is dug and the ash from that ditch used to add a further layer to the kiln covering. Water is added to the top ash layer so that it does not blow away. The high breakage rate means that there is no shortage of broken vessels with which to cover the kiln. In Lodai kilns are small and surrounded by a wall, which provides sufficient ash to cover the kiln. If extra pots are needed to cover the kiln, potters go to other villages and collect broken ones, usually free of charge.

The combination of the triangular shape and the upward slope allows the heat to spread slowly so that pots are fired evenly. The potter Sumar Allan describes here the process commonly used by all the potters interviewed, although the fuel may differ:

> "Once the kiln has been cleared, we spread a bed of *thor* about 20 cm deep which decreases to about 15 cm at the back of the kiln. On that we spread a thin layer, about 5 cm, of finely beaten *thor* and the first layer of pots is arranged on top of that. We put about four fired pots at the mouth of the kiln, where we light it, because direct heat would blast unfired pots apart. We arrange the pots so the biggest ones are at the back and we put a broken sherd under each one so it diffuses the heat from the fuel and there is no direct contact. Then we arrange a second layer of smaller pots on the first one in the same way. We have to do the two layers and the top layer of broken pot sherds at the same time, moving backwards from the mouth. Then we cover the whole kiln with grass and rubbish and put cow dung at the mouth, inside and out. The last layer is a layer of ash, thick at the sides and thin on top. Then we put a match to the kiln mouth." (Sumar Allan: personal communication 1993).

The depth of the *acacia* layer varies according to the season — 23-25 cm in monsoon, 20 cm in the summer and 13-15 cm in winter. If too much is used in winter it can spoil the entire kiln load. During the monsoon however it contains moisture and is soft, and the weight of the pots weighs it down preventing it from catching properly — this blackens the pots. In Gundiyali, where kilns usually contain as many as 1200 vessels, a third layer is added. Lodai potters fire a kiln containing about 300 vessels at a time. The kiln faces west and the pots are arranged in zigzags, each row facing north and south alternately. Potters are skilled in loading their kilns so as to use the space effectively and allow the flames and hot gases of combustion to flow freely around the kiln load.

To cover the kiln, Gundiyali potters also use *thepala*, standard sized clay discs which evenly cover the top:

sherds are then used to cover any chinks. Firing in both areas takes place twice monthly, and it takes a full day to prepare the kiln. Potters watch over the kiln until the heat reaches the centre, while monitoring its progress according to the smoke it emits and by testing its temperature with their hands on the outside. If much smoke is observed, the point where it is escaping is located and covered with ash.

If for some reason firing fails, potters try to rescue the process, since they would otherwise forfeit the income from some fifteen days' work. For underfired pots, they extract pots which can be re-fired and lay a second kiln to complete their firing. Pots re-fired in this way are slightly blackened and the richness of subsequent painting is lost, which lowers their market price. Pots which are over-fired and have cracked are scrutinised to see which can be repaired, and cracks are filled in with cement. Such pots fetch a low price, but do find buyers. Colour variation also occurs as a result of firing: if the temperature is low pots have a dull red colour; if it is too high, they are very dark red, or white. Slip colour can change during firing because of temperature variation in the kiln or salt content in the clay.

Once a kiln has cooled, vessels are removed on the morning of the third day and piled up in the compound. They are now ready for marketing.

Factors Contributing to Change

As the foregoing description has shown, pottery producing systems have stable factors, and factors that are undergoing change. The output of potters in the two areas studied has changed in recent years, an indication of the relationship between the potter, market demand and changes in output and/or manufacturing techniques.

In Gundiyali 42 different types of vessels used to be made. Changes in the last fifteen years have meant that thirteen of these vessels are no longer produced. Most of the discontinued lines are cooking vessels, which have largely been replaced by metal, which is now perceived to be a status symbol. Vessels that were used to carry water to field workers have now been replaced by aluminium cans. The vessels still in production are mainly those used for water and buttermilk, for which there is an unchanged social demand associated with the inherent coolness of traditional ceramic ware; important for keeping water cool and buttermilk fresh.

Symptomatic of the mass production of ceramic vessels in this village, only one type of vessel (*bhaddak*) is made on demand, by a small producer who is in direct contact with his customers, unlike other potters who distribute through middle men.

In Lodai, the demand for vessels for water and buttermilk has remained little changed. Ceramic cooking vessels are also in demand in this region. People believe they are healthier (metal is associated with tuberculosis); they are cheaper than metal vessels and therefore, when the pastoral population inhabiting this area migrates, leaving such belongings behind, they are less likely to be stolen. Also, since painting in this area is of a high standard and socially valued, the beautifully decorated vessels act as a status symbol that outweighs their metal equivalents. Here too, the economic situation is not as robust as it is in the Gundiyali area, and ceramic vessels may often be all that villagers can afford. There is also a closer relationship between potter and purchaser, who value each other's product and custom, and thus a greater variety of vessels is produced on specific demand.

These output patterns indicate that changes in potters' output are not related to potters' techniques, but to the exigencies of market demand, dictated by social customs which themselves show aspects of stability and change. For example, vessels used in death ceremonies (*para* or *kunda*) remain unchanged while decorated *chori* (36 pots purchased once, worth Rs. 200) used for marriages have now largely been replaced by metal *chori*, which can be hired for Rs. 25 for the day. In Lodai, very large pots used to be in demand for water and buttermilk. A change in the pastoral economy means that much less ghee is made as milk can be sold to dairies, so such large buttermilk storage vessels are no longer needed.

It appears to be market demand that is primarily responsible for changes in potters' manufacturing techniques, which have a direct bearing on the quality of the end product. For the mass market, potters do not invest the time they know is required to make pots of high quality, since consumers do not discriminate sufficiently to make this worthwhile. Thus it is quantity that earns money, not quality, as Gundiyali potter Abdulla explains:

> Now more pots means more business, potters don't care about quality, everything works on a contract system. A potter tries to make more pots in a day: the more he makes the more money he gets, he never tries to make something good as it's the number of pots that matters. Previously potters used to see to the thickness, smoothness, shape and beauty of a pot and the consumers used to be aware of quality too. If a pot wasn't properly made the buyer would say it had been made by an inexperienced person and he wouldn't buy it. Now no-one has an understanding about good pots (Abdulla: personal communication 1993).

During the manufacturing process, shortcuts are evident at every stage. Potters do not discriminate in the collection of clay, taking material that has impurities so long as these will not actually cause breakage (Lodai potters: personal communication 1993). They can and do choose carefully, however, if there is a specific order for a vessel of high quality.

All potters reported that they do not age clay because this costs time that is not reflected in an increased income:

> If I age my clay systematically for 4 days the product will be durable, but I don't. I just prepare it every day and make pots, because I get money according to how many pots I make. My father used to age his clay for 4-8 days in a gunny bag but now we keep it in plastic and you can keep it for a month, but it's too much effort, we don't bother (Ahmad Daud: personal communication 1993).
>
> If we kept the clay for longer the quality would be better, but we don't because you need space, and it's hard work. We don't make fine pottery nowadays, we just make as many pots as possible (Hussain Jakham: personal communication 1993).
>
> If we keep clay for two days for systematic ageing all the particles are properly mixed. But as we don't do that, the pot often cracks on the wheel and we can't make fine ware pottery. But nowadays no-one cares, the only concern is quantity (Umar Hussain: personal communication 1993).

Beating and drying techniques have also undergone changes, as Salim Daud reports:

> We used to beat pots at least three times and then even if the temperature did increase during firing the pots weren't damaged. In between the pots were fully dried in the shade, and they were thin too. We used to beat the pots until the core was the right thickness and they were smooth on the inside as well as outside and they were so dry that birds footprints and our hand marks didn't show. Now we just shove pots in the sun so they dry fast, but the core isn't moisture free so it won't be a good quality pot (Salim Daud: personal communication 1993).

As these comments illustrate that goods are manufactured using techniques which allow for speed at the cost of durability and aesthetic appeal, yet maintaining basic functional qualities. Financially the potters' — albeit small — income is relatively secure since market demand remains both high and constant, and there is little competition among them.

The combination of the change in their social standing (Choksi 1994), and the lack of competition, associated with changes in marketing is resulting in an erosion of the amount of energy expended in producing vessels. These interlinked factors result in a lower quality of vessel, but as these vessels still find a secure market, there is no incentive for a potter to produce vessels of a higher quality.

These important changes have coincided with the invention and/or widespread circulation of plastic and metal vessels. Almost all over Kachchh, this has reduced the demand for ceramic vessels in all the varieties that had been available, although some vessels, especially those for water, could not be bettered by vessels made of other materials. Thus market demand has narrowed, preferring a smaller choice from the potter's repertoire — a demand that is assured by an expanding population.

Simultaneously, the wider economy, of which potters were a small component, has become more diversified. Opportunities have became available for employment in non-traditional sectors, such as brick manufacture or other occupations related to industry. Since, as described above, manufacture of ceramic vessels is laborious and insecure, some potters have chosen to shift to these other occupations. With their knowledge of vessel production and marketing, those who had grown up in the pottery tradition often chose to remain closely connected with it, usually as traders.

Modern means of transport, such as trucks and tempos, have in turn allowed that market to become wider. Older links too affect contemporary output: Gundiyali earlier had sea links with Bombay and Porbander and potters migrated to these centres to ply their trade. Many of these potters have now become traders, importing vessels from Gundiyali. Thus market demand in Mumbai affects what is produced in a village 1000 km away.

Lodai, a production centre that caters to the needs of pastoralists, presents a different picture. Potters operate a tiered system of manufacture: for the mass market (albeit in a more limited sense than in Gundiyali); for individual contract traders; and for their own needs:

> For traders or the normal market, we make quite rough pots. For customers with a yearly contract, who give us grain and money in exchange for water pots, we take care and make better pots. But the best products are in our own houses, and our pots have the finest painting too (Sumar Allan: personal communication 1993).

Yearly contracts are becoming increasingly uncommon due to the now disproportionate cost ratio of grain to pots. The largest market for Lodai potters is the pastoral market: it is secure and to a great extent, discriminating. Poorly decorated vessels are not acceptable, and thus time has to be invested in decoration. However, Lodai potters have also taken to making shortcuts in manufacturing techniques which consumers apparently do not notice.

A further factor contributing to change is the non-availability of fuel, especially in Gundiyali where potters are now forced to use *acacia* instead of *thor.* Cow dung as fuel, used to be freely available is on the fields but this has also become a market commodity which potters cannot afford in the quantity required. Both *thor* and cow dung burn slowly, allowing the temperature in the kiln to rise slowly: *acacia* and rubbish both burn fast. Because potters no longer take the time to dry the core of their vessels, the use of such fast-burning fuel further increases the likelihood of breakage during firing.

Archaeological Implications

This paper illustrates that contemporary manufacturing techniques are highly complex. It remains therefore to draw inferences from the above discussion, in order to assist the archaeologist in avoiding the error of oversimplifying the potter's craft, and thus to making errors in interpretation.

In order to be economically viable, contemporary potters cannot afford the time to travel far for the resources they need in large quantities, e.g. clay or fuel. Potters interviewed in Kachchh do not travel more than 10 km for such items, but may travel up to 80 km for resources needed in smaller quantities. It should not therefore be assumed in the archaeological context that it is a vessel that travels a long distance: rather, it is more likely that it is the potter with the technological knowledge to produce that pot who travelled and exploited local materials. The provenance of a vessel can be checked through petrochemical studies, which can be helpful to derive the relationship between the location of a source of clay and the composition of a sherd.

In classifying ceramic sherds, texture is taken to be one of the major identifiers, e.g. Coarse Red Ware or Fine Red Ware. The following examples show the importance attributed to texture as a way of characterising the proportion of particular wares at a site:

> The ceramic assemblage from Padri can be divided into two broad categories, namely fine and coarse ware... Both these wares can be divided into a thin and thick variety (Shinde and Kar 1992: 105).
>
> The ceramic traditions of this period consisted, beside the Harappan black over red ware in diminishing frequency, of a coarse red ware, which though it starts to be recorded from the Middle levels of the period IA upwards (2-10%), comes to form the bulk of the ceramic yield (up to 70%) (Joshi 1972: 129).

A second approach is to note changes in texture and to attribute such changes to resource availability (italics added):

> There are quite a number of vessels of coarse fabric in Period IIC. But sturdy vessels of superior fabric are not negligible. One may be inclined to argue that the occurrence of an inferior variety of the red ware along with the superior ware many be one of the intrusive elements of a new culture in Rangpur IIC. But it must be noted that the characteristic Harappa forms as well as the evolved ones are found both in the sturdy and coarse varieties. It is further observed that simultaneously with the evolution of new ceramic forms, *the bulk of the vessels became coarse owing to the non-availability of fine alluvial clay in sufficient quantity* (Rao 1963: 60).

Although Rao may be correct in drawing this conclusion, potters interviewed for this study commented that while the availability of raw materials has changed, they are able to exploit existing material according to their requirements. None specified raw material as a criterion in the deterioration (or 'coarsening') of the pottery they produced. The ethnographic evidence suggests that changes in texture are deliberate, rather than dependent on natural resources. This evidence does not support Rao's position that the potter is dominated by the availability of his materials; rather, it appears that he makes a series of choices which conditions his output. Coarse varieties may be deliberately produced for various reasons: e.g. to fulfill a particular functional category (e.g. cooking vessels); or to meet market demand (perhaps the fine ware was expensive).

Simple category-based textural description of sherds are also problematic, since two textural categories — coarse and fine red ware — can be created in a single pot, as in Lodai. Such differentiation would almost inevitably be lost by an archaeologist sorting sherds according to textural categories, since the fine rim would be separated from the coarse base. Similarly, rustication can also account for two textual categories in one pot. A single potter can produce wares with very different textural characteristics to meet the demands of his market, as well as to fulfill the requirements of different vessel functions.

It is therefore very important to try to understand why different textures of vessel exist; which kinds of vessels belong to a particular textural category; and why those textural categories themselves even arise.

Colour has provided another basic criterion for categorising vessel sherds. Depending on the colour of the sherd, it may be classified as a sample of Red Ware, or Buff Ware, or Black and Red Ware, etc. Some reports go further, and note which slip is applied to which Ware:

> A red-ochre slip is found to have been applied over the Red Ware and the Micaceous Red Ware, but rarely on the coarse red wares... The Micaceous Red Ware vessels are treated with an orange slip... Patches of red, buff and pinkish slips noticed on some pots and various shades of yellow, red and orange occurring on others may be due to the presence of iron compounds in the clay or due to differential firing... A chocolate slip is noticeable on some vessels of the Red Ware as well as the Buff Ware groups (Rao 1985: 336).

This observation attributes the different coloured patches and shades of vessels to the composition of the clay, and/or differences in firing. This is to some extent corroborated by the ethnographic evidence which indicated that colour variations do arise from both: many colour variations can occur in a single kiln, according to the type of *geru* applied, and the firing process itself.

However, Rao's report does not acknowledge that the potter/painter might have intentionally produced a colour variation in the ceramic assemblage. For example, Lodai potters/painters apply a very light slip to the *man* in order to obtain the particular light orange tint preferred by pastoralists. Similarly, a pink tint is produced for ritual vessels through the application of a very thin white slip on a red vessel. The potters/painters deliberately manipulate their materials in order to produce the type of wares that are in demand from the community whose demands they seek to fulfill. Variations in colour occur for a reason: the nature of the economy or preferences of the particular community which purchases a particular pot for a particular reason

Understanding sherds in this way can lead an archaeologist to approach their classification in a different way. For instance, one could try to use the proportions of particular coloured wares at a site as an indicator of community demand. If there is a set of sherds which occur in a very low percentage, this might be because the vessels had ritual significance or they could be the remains of a less frequently used vessel of a very small community.

Colour variation in the same vessel is again often an indicator of community preference. Gundiyali simultaneously manufactures water vessels which are identical in every respect except colour, to fulfill the demands of one community which prefers white slipped water pots and another which prefers red slipped water pots.

Variations in the shape of a vessel can occur for many reasons, some of which may only become apparent if an archaeologist is well acquainted with manufacturing techniques. They may take place during the manufacturing process itself, for instance as the result of different potters making the same type of vessel, the same vessel being made by an apprentice, or seasonality.

Conclusions

To some extent a potter is constrained by what is technically possible using the raw materials and tools which are available. But pragmatic choices are the critical factor in determining a potter's output. For example, market forces mean that potters in Gundiyali are now financially better rewarded if they produce large numbers of pots rather than a small number of better quality vessels. The social circumstances of production equally affect a potter's choices about what to produce; for instance a Lodai potter will be very much more careful producing pots for pastoralists than when producing for the more general market.

It is not that potters do not know how to make 'better' pots, but that it is not viable for them to exercise this knowledge. In this way, potters do not exploit the full range of what they know to be technically possible. Their output is not, therefore, conditioned solely by natural constraints, such as the availability and quality of their raw materials — but by social constraints, for example what is worth their while and viable, both economically as well as socially.

Equally, in order to produce vessels in greater numbers, potters make technological changes to minimise their labour. In so doing, though, they must retain a core set of techniques - otherwise they would be putting at risk their product, and thus their income. However, since a potter works in a symbiotic relationship with society, forces beyond the pottery-manufacturing system with its inherent technological possibilities and constraints, have an important influence on the choices a potter makes when manufacturing ceramic vessels. These forces condition not only the appearance and quality of a potter's material output, but also which shapes are retained, which are adapted or no longer produced. Such changes do not occur in isolation, but as a result of change in the lifestyle, tastes or preferences of those who use the vessels.

In this respect, the very techniques of production are held in the balance between material and social possibilities; it is not technological and material possibilities alone that account for the texture, colour and forms of the material inventory. A major constraint of technique is not nature, but culture, and it is this constraint that deserves much closer consideration in the interpretation of the archaeological record.

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A Study of the Living Megalithic Culture of the Anals of Manipur

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Abstract

This paper deals with the Megalithic practices of the Anals of Manipur, one of the eleven Naga ethnic groups. Upright stones are to be seen all over the areas inhabited by the Anals, but very little information about them is available. Here various kinds of megaliths and the ceremonies connected with them are documented based on information collected from the elderly inhabitants.

The People

The Anal tribe is found in all the subdivisions of Chandel District, Manipur, viz. Tengnoupal, Chakpikarong and Chandel itself. Scattered pockets are also found in Churachandpur District, Manipur and in some parts of Myanmar. The Anal inhabited area is bounded on the north by the kindred tribes of Moyon, Monsang and Lamgang, on the south by the Kuki-Mizo tribes like the Thadou, Zou, Baite, etc. and on the west by the Purums and Meiteis of the Manipur valley. Hence, they occupy mainly the Yomadung range stretching from north to south between the Manipur valley of India and the Kabaw valley of Myanmar. The Anal villages are also situated both on the eastern and western banks of the Chakpi river which runs through the Anal inhabited areas and plays a very important role in the life of the Anals.

Anal Megalithic Sites

Information regarding the Megalithic rituals as practised by the Anals has been collected from a number of villages: Anal Khullen, Lamphou Charu, Khambathel, Phiran Machet, Phiran Leihao, Beru Khullen (Augthi), Modi, Lamphou Pasana, Toupokpi, Chandel Khullen, Chakpi Karong and Sugnu Lamhang. Although megaliths are found in every Anal village, the present paper is restricted to the Megalithic remains from the villages of Anal Khullen and Lamphou Charu.

The Anal Khullen Site

This village is located in the southern part of Chandel District. It is situated on the eastern slope of the Khella Hills which form a part of the Yankhenching range, and is about 103 km away from Imphal. The site is surrounded on the east by Oklu village and the Namunglok stream, on the west by the Chakpi river and still further west by Chakpikarong town. On the north it is bounded by the Phunallok stream and Lamphou Charu and on the south by the Tuiyang river and Khobung Khullen.

The Anal megaliths are found on a ridge of the Khella range right near the main gate and in front of the present temple of the *Wangbarel* and *Shangnu*. There are also stray finds of Megalithic monuments inside and outside the village particularly near the inter-village road. The total number of such megaliths, forming an avenue, is 221.

Megalithic Types

The extant Anal Khullen megaliths are of two kinds based on their structure and function:

Tutangkam (menhir): a memorial stone raised as a mark of honour after the death of the merit-seeker, who performed the seven series of feast-of-merit.

Lungpatha (small menhirs with enclosures): a memorial stone raised by the performer of a feast-of-merit during his/her lifetime.

A. Tutangkam (Fig. 1-2)

Tutangkams are a pair of small upright stones always forming a constituent part of an avenue of their respective clans. Functionally they are memorial stones raised after the death of the performer and his wife who had offered a series of seven 'feast-of-merit' ceremonies called

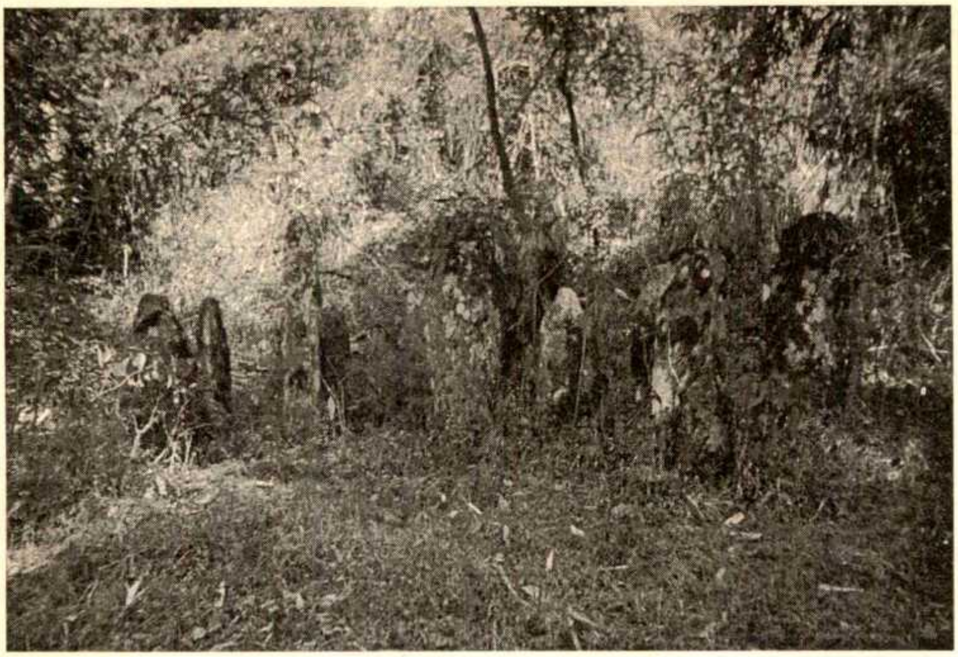

Fig. 1: Anal Khullen: a set of two alignments formed by a group of *Tutangkams*

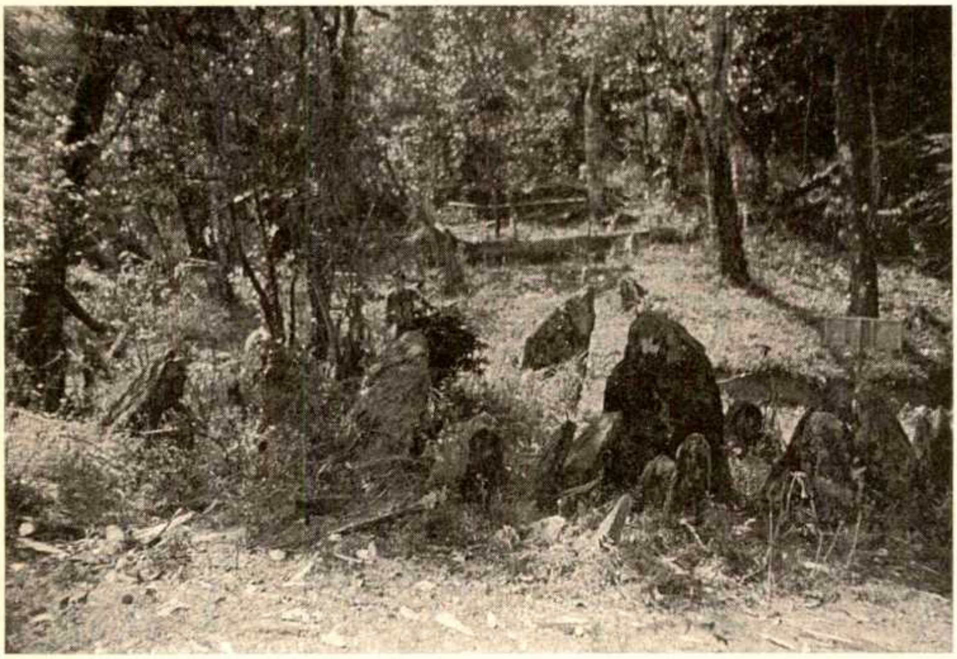

Fig. 2: Anal Khullen: a part of an avenue formed by a number of *Tutangkams*

Tutangkam (also known as *Akam* sacrifices). The stone thus erected is also known by the same term *Tutangkam*. Such stones cannot be raised by the performer in his name or that of his wife while they are alive. They are only permitted to select suitable stone(s) to be erected after their respective deaths.

If an Anal Naga wishes to select a pair of stones to be raised after the death of both himself and his wife, he has to perform a series of seven 'feast-of-merit' ceremonies. Normally these feasts should be performed within six consecutive years and the last two feasting ceremonies are to be performed in the same year. However, this is hard to accomplish and it is more common to have an interval of one or two years between the feasting ceremonies, except the last two (6th and 7th). For many people therefore, the whole series cannot be completed during one's lifetime especially if it is started in old age. If however, the intending performer is unable to perform the whole series or even a number of feasts he is not allowed to raise megaliths either in his own name or that of his wife. If the merit seeker completes the feasting ceremonies upto the third stage (of the seven) his wife is allowed to raise a megalith in her name after her death in their clan's stone raising place to constitute a part of an avenue of the clan. Another megalith is given in the name of the performer if he completes the sixth or even fifth feast of the series. The important seven series of *Akam/Tutangkam* feast of merit are: 1) *Inthungnaju* or *Inthungju*, 2) *Buphung*, 3) *Shah-pe-a*, 4) *Lan*, 5) *Akah Pedam*, 6) *Duthu*, and 7) *Sontang-Petang*.

1. *Inthungnaju or Inthungju*

This feast is usually given in the month of March. The performer gives out notice of his intention to perform the ceremony to the village through the village headman, about two months in advance. Thereafter, 22 days before the ceremony he and his family members prepare rice-beer (*Momyu*). He also has to arrange to provide for the ceremony: one dog, one pig, one hen, one cock, rice (minimum 800 kg), vegetables and *Mom* for the preparation of 500 litres of *Momyu*.

The *Inthungju* lasts for three days and usually starts in the evening. On the first day dancing — *Akadam* — commences around 11 p.m. and continues till dawn. This is usually performed by unmarried boys and girls of the tribe, but even old men and women join in if they wish. Singing should be done by the old men only. During *Inthungju* all the feasting, dancing and singing should be carried out inside the performer's house.

2. *Buphung*

In the year after the *Inthungju* feasting ceremony, the *Buphung* feasting ceremony is normally performed in the month of March. The whole process is similar to that of *Inthungju* (except that the amount of *Momyu* is increased to 600 litres).

For the second feast, the performer should request all villagers, according to their age, to help in the collection of firewood, banana leaves, vegetables, preparation of *Momyu* (rice beer) and slaughtering of animals.

3. *Sah-pe-a*

Sah-pe-a is also performed in the month of March one year after the *Buphung* feast and lasts for three days. Dancing may take place in the courtyard of the performer of the feast. The number of dogs, pigs, hens, cocks, and the quantity of rice and vegetables remains the same. Additionly three eggs, one mithun (*Bos frontalis*) — four or five years old, and one forked-post or the *Chaling* are necessary. Above all, the amount of the *Momyu* is increased up to 850 litres.

As in the two previous feasts, the animals should be normally killed by the village youths and cooked on the first day to serve the participants. On the same day one friend of the merit seeker ritually kills the mithun.

Thereafter (on the first day after killing all the animals), the village priest erects the *Chaling* to which the mithun is tied. The priest then purifies the mithun by breaking an egg on the frontal bone between the horns. The purified mithun is then ritually killed. One individual pretends to spear it while the performer's closest friend actually spears and kills it. The animal is then cut into pieces which are cooked to serve the participants. However, a share is specially saved for the slayer which includes a piece of eye, ear, tail, legs, liver, heart, stomach and intestine.

The main purpose of the 'feast-of-merit' is to feed the whole village as well as guests and invitees from other villages and spend the three days singing and dancing. After this feast, the performer's wife is allowed to select a menhir in her name, but the erection of this megalith is done only after her death. The forked-post erected on the first day of *Sah-pe-a* to tether the mithun remains as a decoration for the house.

4. *Lan*

A year later in the month of March, the *Lan* is performed and lasts for three consecutive days. The difference between this 'feast-of-merit' and the earlier ones is that the *Momyu* is increased to 950 litres and instead of one forked-post, nine Y-shaped posts are raised, not only to tether the mithun but also as being symbolic of the 'feast-of-merit'. They remain as decorations for the house till they are completely decayed.

5. *Akah Pedam*

Lan is followed by *Akah Pedam*, usually after a year's interval and again this is performed in March. This ceremony continues for four days and is similar to the *Lan* feast except that the *Chalings* increase from 9 to 11 and the quantity of the *Momyu* to 1150 litres.

After completing this, the fifth feasting ceremony, the performer is allowed to select a stone to be raised in his name after his death

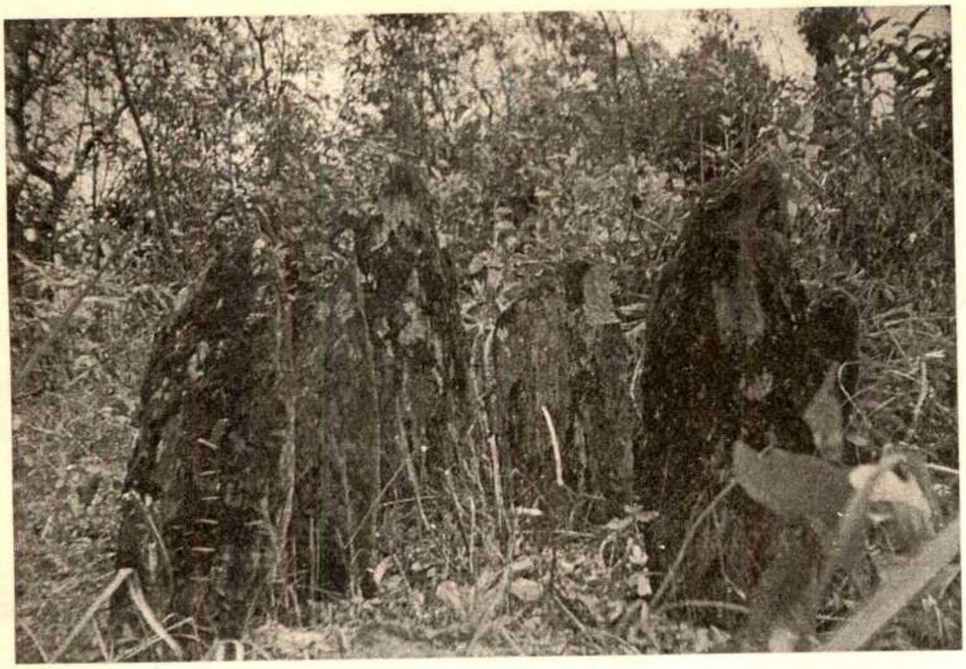

Fig. 3: Lamphou Charu: the *Tutangkams* (menhirs)

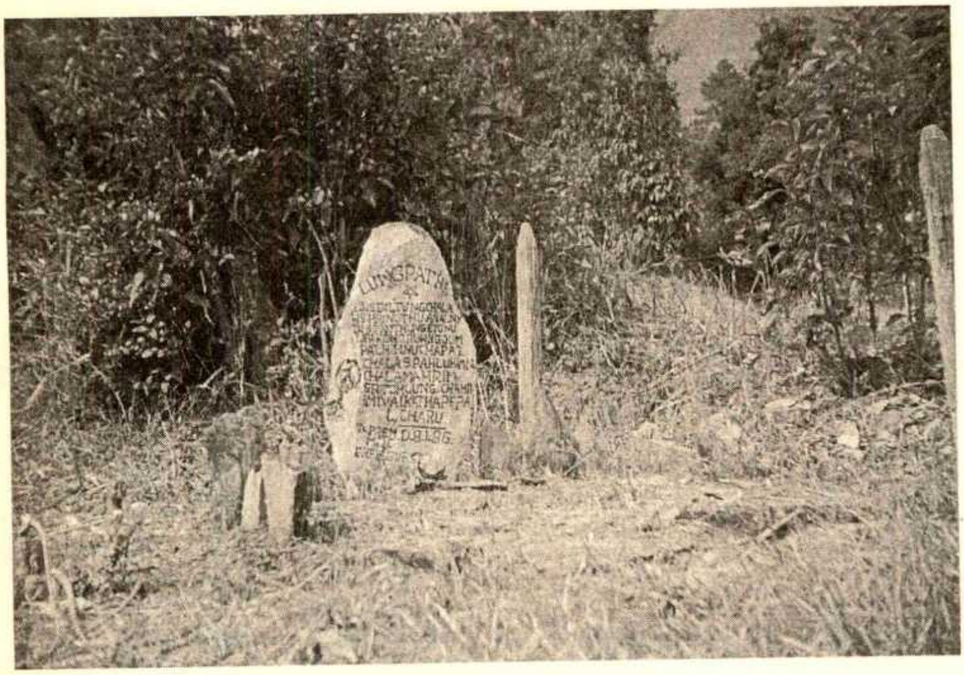

Fig. 4: Lamphou Charu: the *Lungpatha* (small menhirs with enclosures)

6. *Duthu*

The penultimate feasting ceremony of the series lasts for five consecutive days and usually performed in March. The quantity of the *Momyu* increases to 1600 litres.

On the first day the containers of *Momyu* are kept before the assembled villagers in the courtyard of the performer and the number of rice beer pots are counted. Then drinking commences at around 10 O'clock in the morning and the dancing begins at noon.

7. *Sontang-Petang*

This is the last ceremony in the seven 'feasts-of-merit' and is usually performed in the same year as the *Duthu* (usually in April). The performer requests the villagers to help him to clear and cut the *jhum* fields, specially prepared for the occasion. On these cleared areas various kinds of crops will be sown by the merit-seeker saying that such crops would be the share of the birds and animals and that he could neither reap the crops nor pluck any vegetables from these fields. The birds and animals easily consume these crops and very poor villagers also gather whatever they like from these fields. This is not an elaborate festival as the merit-seeker would normally serve the villagers and helpers with food and drink, while the clearing, cutting, tilling and sowing of seeds is carried on.

The merit-seeker or performer of these seven 'feasts-of-merit' therefore is respected by all not just in their lifetime but also after death. In Anal Khullen village there were more than a hundred persons who had performed *Tutangkam* and raised menhirs in their names to form an avenue there.

B. Lungpatha

A pair of small upright stones (*Lungpatha*) are raised after the celebration of a great feast, mainly by those unable to perform the *Tutangkam* ceremony. These upright stones are much smaller than any of the *Tutangkam* menhirs. Anyone intending to raise them may give a feast on only one day and on the same day this structure is erected, always near the village gate or the side of the road. The small upright stones are surrounded by a number of small stones arranged at regular intervals to form a rectangular enclosure mainly as decoration.

There are no specific rules regarding the erection of these *Lungptha*, and the feast is usually held by childless couples as their memorial stones in their lifetime.

The Lamphou Charu Site

Lamphou Charu is located on a spur of the Yangkhenching range about 109 km to the south of Imphal. The village is surrounded by Phiran Machet and Phiran Leihao on the east, by Anal Khullen on the south, by Beru Khullen on the west and by Modi and Lamphou Pasana on the north, all of which are Anal villages.

In this village area, the present writer came across two types of Megalithic structures (Fig. 3-4):

A. *Tutangkam* (menhir): memorial stones raised after the death of the performer of the seven series feasts-of-merit.

B. *Lungpatha* (smaller menhirs): memorial stones raised by a performer of a 'feast-of-merit' during his/her lifetime.

The rituals, feasts and ceremonies connected with the erection of the above mentioned megaliths found in Lamphou Charu village are the same as those of the Anal Khullen sites.

In Lamphou Charu village 7 villagers had performed the *Tutangkam* feasting series. Out of which only two (St Shadel and R.L. Behring) were able to complete the whole series. One person (Sr. Kalnal) reached the fifth stage (*Akah Pedam*), another (Rng. Kamvol) performed up to the third stage (*Sah-pe-a*), while others (L.K. Bejing, R.L. Chumvol and K.T. Bethi) were able to complete only the second stage (Buphung).

According to their tradition, St Shadel, R.L. Behring and Sr. Kalnal were allowed to select and raise a pair of stones each, one for the performer himself and the other for his wife. Rng. Kamvol has only erected one stone in the name of his wife, while L K. Bejing, R.L. Chumvol and K.T. Bethi were not allowed to erect *Tutangkam*.

Social and Religious Significance

The author's ethno-archaeological study of the megalithic cultures found among the eleven Naga groups in the Chandel district of Manipur provides a suitable model to shed light on the socio-ideological aspect of the society under study. In order to explain the significance of the various megalilths of Manipur, these rude stone monuments are divided into the following broad groups:
(a) memorials and commemorative stones or menhirs indicating social status and (b) funerary and ritualistic megaliths.

The Anals raise megalithic structures in their own names while still living or sometimes after death. From the point of view of their socio-religious significance, these comprise memorials and commemorative structures or menhirs of group (a) above.

The different megalithic types include menhirs, alignments, avenues and cromlechs, but the underlying idea behind their erection is to attain a social prestige. Among the Anals therefore, different kinds of sacrifices were performed according to their religious beliefs. Among them, the *Tutangkam* 'feasts-of-merit' known as the *Akam* series of seven sacrifices is the most important and is performed by well-to-do persons to attain a high social prestige during their lifetime and thereafter to lead a happy life in the land of the dead. Though there is no clear concept of salvation among the Anals, those who have done good works with honesty, may live for eternity in *Athokpam* or *Tang Sanbung* (the mythical land of the dead). With this view in mind the Anals perform a series of sacrifices. As these sacrifices are accompanied by grand 'feasts-of-merit', only wealthy villagers can afford to perform them. Here charity seems to have been considered as the moral basis for the attainment of social status. However, rich persons, who have committed incest and theft, who are widows and widowers are disqualified from performing this series of sacrifices.

Megaliths of different shapes and sizes and also representing the different stages in the *Tutangkam* feasts and *Akam* sacrifices are found on the outskirts of villages like Anal Khullen, Lamphou Charu, Oklu, Phiran Machet, and Phiran Leihao.

The *Lungpatha* represents a secular type of stone monument erection — raised by both Christian converts and traditional religionists. Their significance in the Megalithic culture of Anal Khullen is that this so-called secular character really only represents a social adjustment to accommodate Christian converts. The religious part of the Megalithic ceremonies is not given as much importance as the social aspect, and may be considered an unique example of cultural adaptation of the age-old megalithic tradition by Christian converts.

Affinities

The problem was given a fresh perspective by Wheeler's excavation in southern India (Wheeler 1948) and by Gordon Childe's (1948) discussion of Indian megaliths in relation to those of Europe and Southwest Asia. What is most important is that we should not assume a connection between two traits in two cultures unless we can prove that the traits are formally, constructionally and functionally identical and can demonstrate the chronological and geographical possibilities of connection. It is by no means impossible that megaliths originated in southern Europe and spread to India, Indonesia and Japan; but before we can assess the different points of view about the unity or disunity of megaliths, we need careful analysis of the structures in different regions (Daniel 1963: 25-26).

Here our concern is with the megaliths found among the Anal Naga group of Manipur. Schnitger (1961) who studied the megaliths of the Nias in Southern Sumatra makes a note of the common factor of the 'feast-of-merit' ceremony ardently followed by the Naga and Nias megalithic builders. Comparing the two regions he notes that

> "... even the most superficial considerations teaches us that the cultures of Nias is related to that of the Nagas of Assam. In both countries social life is largely dominated by the Megalithic institution and the necessary feasts and ceremonies involved. In Nias this is much more true than in Assam, for among the Nagas there was only a few tribes (such as Angamis) who possesses a highly evolved Megalithic culture. Among the Nagas as well as in Nias the accompanying assignment of rank assumes a prominent place. In spite of the differences which exist between the Nagas and the people of the Nias, the similarities between their Megalithic cultures are so striking and are so numerous that there can be no doubt of their relation. They must at one time have had a common land of origin and this can have been nowhere but in the valley of the Irrawaddy... not only ethnologically but also anthropologically the people appear to be related. I am inclined to include Nagas, Niassians, Dayaks, Phillippinos and Formosians in one large group" (Schnitger 1964 145, 150, 152).

Further, Haimendorf recognises that the megalithic culture of the Nagas represents a particularly ancient form of megalithic complex widely spread over southeastern Asia, a form found only in a similar state of development on the small island of Nias and perhaps on Luzon in the Phillippine islands. He draws a close similarity in the carving of buffalo or mithun horn motifs on the megalithic monuments of the Nagas and those found in the Indonesia. He concludes that the idea associated with megalithic ritual to gain prestige for the living and to establish links with the souls of the dead is at the root of the megalithic cultures of Indonesia and thus suggests a unity of the megalithic complex extending from the Naga and Khasi hills over Nias to Flores, Ambon and Ceram. He therefore opines that the megalithic complex found in Assam and in many other parts of South East Asia appeared not as an accidental aggregation of various cultural elements, but as a well co-ordinated system of customs and beliefs, a philosophy of life and nature (Haimendorf 1945: 74).

In a sense all megalithic practices all over the world are associated in one way or another with the cult of the dead. That itself is not sufficient grounds to establish a common origin between any two megalithic cultures. The author believes that the social and ideological aspects of different megalithic cultures must be examined before attempting to establish close relationship or even a common origin.

The megaliths found among the Anal tribes of Manipur are accompanied by a series of feasts. Feasting by definition is a major feature of the 'feast-of-merit' series. Similar feasts are also performed by wealthy people in the Chin Hills of Myanmar who sacrifice a pregnant cow or a mithun in one of their feasts as done by the Anal Nagas.

Chronology

The dating of megalithic monuments was a problem for a number of years. Sir Mortimer Wheeler proposed 200 B.C. as the probable date of the megalithic culture based on evidence from the Brahmagiri excavation. However, Gordon Childe and von Furer Haimendorf pushed it back to a period between 1100 and 700 B.C. when, according to them, the iron-using people came to south India from the Mediterranean.

Some megalithic monuments have been dated firmly on the basis of the radiocarbon and in Northeast India, so far one date has been obtained from the post-Neolithic site of Marakdola in the Khasi Hills, assigned to 658 ± 93 years B.P. or A.D. 1292 (half-life 5570 ± 30 year) (Rao 1979: 202).

This date is only applicable to the site of Marakdola and cannot be extended to the entire northeast region. Even among the Khasi Hills it can only indicate that the megalithic culture flourished in here in the 13th Century A.D., whereas Manipur megalithism continues to be practised even today by various Naga tribes inhabiting different parts of the State.

It is very difficult at this stage to give an exact date for the erection of the megaliths found among the eleven different Naga tribes of Manipur. Excavation of some of the megalilthic sites in order to understand the cultural status and also the chronology was not possible, as the megalithic fields in every village surveyed are considered living monuments and are protected by the villagers who are not inclined to accord permission to dig or disturb the megalithic structures even in deserted megalithic fields.

Consequently, even though it is not possible to indicate an absolute date for the megaliths found in various parts of Manipur, most authorities agree that the megalithic culture is undoubtedly a prehistoric tradition and in this land-locked isolated corner of India has survived as a living tradition performing a very significant sociocultural role — the attaining of a higher social status — among the Naga tribes of the State.

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Interview with Dr. F.R. Allchin and Dr. Bridget Allchin

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The contribution of Dr. F.R. Allchin and Dr. Bridget Allchin to the field of South Asian Archaeology is too well known to be repeated here. This interview was conducted during theXXV Annual Conference of the ISPQS held at Srinagar, Garhwal, Uttar Pradesh, 1997.

S.P.: How did you develop an interest in archaeology? In particular, what were your reasons for choosing Indian archaeology as your special field of research?

Bridget Allchin (B.A.): Well, as a child, I was always interested in archaeology. In the U.K after the War, archaeology was not an undergraduate subject. Ayear after the War, my parents and I moved to South Africa, to Cape Town, where at the University, a degree course was taught in Archaeology, Anthropology and the Bantu language. This was a very good department which had a number of Africans studying there as well. My involvement in Indian Archaeology began after my marriage to Dr. F.R. Allchin. He will tell you how he was initiated into Indian Archaeology. I met him while doing my Ph.D. at the Institute of Archaeology, London, and he was studying for his doctorate at the SOAS. An ex-servicemen's grant paid for my visit to India, where I soon became interested in different problems in Indian prehistory and this led to my developing an interest in other aspects of Indian archaeology.

F.R. Allchin (F.R.A): I was introduced to archaeology in my boyhood, although I had no intention then of taking it up as a career However, after the Second World War; one left school earlier then; I read architecture for my intermediate examination for three years. Then I went on to the army automatically, after the course, and joined the Royal Corps of Signals. I hoped to be sent to Italy, this was at the time of the Allied Invasion, but found myself in India. I was first sent to Mhow, then to Agra and then back to Mhow. The first archaeological site I saw was Sanchi, along the Grand Trunk Road. There was this strange monument on a hill top, and I can say that my interest in archaeology started from here. On my second posting in Mhow, I went on cycle excursions to Mandu and explored the region. This was the beginning of my interest in archaeology. Two years later, I was sent to Singapore and was waiting to get out of the army. I sat and wrote out options open to me on a piece of paper. I had decided not to pursue architecture as I disliked modern architecture. It didn't occur to me to enter into archaeology as a career. On the other hand, I liked India. I interested in archaeology, because in school, I subscribed to the Illustrated London News, an illustrated magazine, which in the 1920's and 1930's carried articles on archaeological sites. When in school, I read a report on Mohenjo-daro and Chanhu-daro by Mackay, which interested me. On arriving in India, I noticed various things; walking around the countryside and living off the land, I began thinking that villagers were not so very different from people of the Indus Civilization. This was one of the central themes which started me off in Indian archaeology.

S.P.: Dr. Bridget Allchin, this question is specifically addressed to you. In the field of Palaeolithic archaeology, your work in Western India, forms one of the major landmarks in Indian prehistory, being as it is one of the first attempts to utilise a multidisciplinary approach in the study of past lifeways. Would you comment on the principal aims and results of this work?

B.A.: It was very clear at an early stage, that no work had been systematically done on past climates in India. "There has been no climatic change in India", was what people said at the time. I thought it was an essential aspect of Indian archaeology and so organised an interdisciplinary project with Baroda University, where Prof. R.N. Mehta, was most helpful and open minded and encouraged me greatly. Other members of our team included Andrew Goudie, from Oxford University, a specialist in desert geomorphology, and who studied the dunes; K.T.M. Hegde who was a soil scientist; and I was the archaeologist of the team We were able to establish definite evidence of climatic change in this area. And so was Gurdip Singh who was also working in this region.

S.P.: One of the points which you emphasized in this work and also elsewhere was the need to adopt more regional groupings within the Palaeolithic; e.g. as in the use of the term 'Nevasian'; in order to distinguish these groupings from larger technological phases. Can you comment on this?

B.A.: Yes. In the Indian Middle Palaeolithic, there is a distinct difference between the Middle Palaeolithic of Peninsular and Central India and that of Western India and Pakistan/Afghanistan. The Thar is the place where these two traditions meet. In Central and Peninsular India the Middle Palaeolithic developed out of the Lower Palaeolithic without much outside influence. During major dry phases, the deserts and mountains cut India off from the rest of Asia. Different Middle and Upper Palaeolithic technologies developed in the North-West, during conditions when the climate was hospitable, such as during the formation of red soil in the Thar desert when savanna conditions facilitated hunting; and hunters migrated here from the South-East and from the North-West.

S.P.: While on the subject of the transition from the Lower to the Middle Palaeolithic, what do you think about the nature of these transitions in the Indian Palaeolithic context?

B.A.: The nature of transitions differed in different parts of South Asia and the world. In Central Asia and Afghanistan and North-West Pakistan (as seen in Sanghao cave), there is a definite overlap in the technology of the Mousterian and blade technology which seem to run side by side. This comprehensive technology travelled to the northern part of the Thar desert during the Middle Palaeolithic. A definite Upper Palaeolithic technology is noted in the Vindhyas and in the Thar. In Northern and Central Gujarat it is sometimes difficult to distinguish this phase from the Mesolithic. In North Gujarat even during the Mesolithic, flake and blade technology existed side by side. This situation is similar in Karnataka as well.

S.P.: Throughout your career, you have emphasized the need for ethnoarchaeological studies. Could you comment on this aspect? How far do you think such studies are relevant in the case of the Lower and Middle Palaeolithic?

B.A.: Well, ethnoarchaeology may not be really relevant as related to the Lower and Middle Palaeolithic. It is important in so far as it helps in understanding how people utilized different modes of subsistence, how they utilized their environment. It cannot be used specifically as in the case of the Upper Palaeolithic or Mesolithic. The further back one travels in time, the more one can use ethnoarchaeology only in general terms. I would however, insist on emphasizing that the whole Subcontinent is the best field in the whole world for ethnoarchaeological studies. People who live here don't quite realise this fact. In India, archaeologists having been doing ethnoarchaeology even without using this term. Marshall, for example, while interpreting his findings, looked at the local people of Sindh, in terms of their bullock carts and the round clay balls using by boys as sling shots. Indian archaeologists, while noticing all these facts, generally put them down as notes in relation to the sites they are working on, but rarely go further .Marshall too, never continued his work, along these lines in a systematic manner. It is most important for young people to observe and talk with local people and they can find out lots of interesting things. A very good example is that of Inamgaon where the houses or huts of different local modern communities are very similar to excavated ones. My own personal observation is that it is much easier for women to do this. Local women are less self-conscious of women ethnographers and one can freely enter kitchens, observe modes of cooking, and other aspects of their lives.

F.R. Allchin: Yes, it is really very important. A survey of sites in the Raichur Doab and surrounding hills shows that they were terraced — this was later very clear at Tekkalakota. There were these little terraces on which houses and fields were made. We photographed modern huts which stood on these terraces and they were really very similar to Neolithic huts. At Piklihal, we found fragments of burnt wattle and daub and larger fragments of mud plaster of door entrances. These were very similar to that used in modern huts. At Utnur, we excavated an area owned by a Reddy. He told us that the site must have been a cattle keeping one and that they must have lit bonfires to scare away beasts as done at present. This was also told to us by a local *gwala*. They knew the purpose of the floor marked with imprints of cattle hooves and they also said that the cattle hoof sizes were bigger than what they are today. I also became aware of the importance of a systematic study of place names. Place names reveal a great deal. Not only did Neolithic site names have the *kal* element, but many *hallis* and *pallis* were agricultural villages, while the Lambadi settlements were called *tandas*. The cultural history of places is contained within place names. They are really an aid to reconstructing past histories. For example, the word *budi* as in Budihal, is probably derived from the Sanskrit *bhuti* or ash.

S.P.: Dr. Bridget Allchin, your work has encompassed the prehistoric archaeology of Pakistan and Sri Lanka, apart from that of India. Would you comment on the present state of South Asian Palaeolithic Archaeology?

B.A.: The South Asian environment makes some technologies developed in the West outmoded. It is necessary to develop your own technology appropriate to South Asian conditions. This is because, unlike in the West, where sites are deeply buried, most sites in South Asia are either heavily eroded or deeply buried under silts. Therefore, the whole technique of studying sites, site formation processes and site disturbances, has to be developed for South Asian contexts. The discipline is sure to attract more students in the future. Studying site contexts is really very important. In the Potwars, for example our team completely reversed the hypothesis of de Terra and Paterson, working in the 1930s who had thought along the lines of a static landscape. This is rare in the Himalayan contexts, and one must develop new approaches in the light of new theories of plate tectonics. It is very exciting to think along these lines. Rajaguru has also talked about the importance of plate tectonics in understanding sites, in particular in north India.

S.P.: and You have long called for a problem-oriented approach in Indian archaeology and have criticized the waste of time and funds in large-scale excavations. Do you think the situation has improved today?

B.A.: The condition is certainly improving and more people are aware of the importance of a thorough survey before excavating.

S.P.: You have consistently stressed the importance of the conservation and preservation of India's archaeological heritage. What do you think of the present state of affairs?

B.A.: An enormous amount of work and a great deal of effort is required for this. One must arouse the interest of local people and authorities in taking pride in their heritage. They are the only ones who can do so. Young archaeologists must take an interest in educating local authorities on the importance of conserving not only major sites but also minor ones. One must keep on working for this as the rate of destruction is very rapid. One should also try to put archaeology onto TV channels. Short articles, although important, are not of much use in sustaining the interest of the general public. New discoveries should be publicized on TV, and there should be a regular slot to talk about these. Curators of local museums should also be encouraged and invited to talk on these programmes. One must press on, and attract people. It is an exciting project and very essential.

F.R.A.: I agree with what my wife says. Monuments at the national, state and local levels must be preserved. There is a dire need to decentralise responsibility and to arouse interest at the local level. We had studied groups of rock paintings at Piklihal in 1957 but when we returned to them again in 1972, we found that the whole rock had been destroyed — a rocky mound 30'-40' in height — totally gone due to road building activities! When Paddayya excavated Kodekal, he took me to an occupation site we had noted earlier, and we found the whole ground dug over and re-levelled and there was nothing of the original stratigraphy left. Sites are being so rapidly destroyed. This is where what I call the Allchin Law comes in 'Economic progress and population expansion are certain to lead to the destruction of archaeological sites'.

S.P.: Dr. Raymond Allchin, your excavations were largely responsible for establishing the principal features of the South Indian Neolithic. In particular you were the first to confirm Robert Bruce Foote's hypothesis of the ashmounds being Neolithic in age and being associated with cattle rituals and a pastoral community. Would you like to comment on your research in this field?

F.R.A.: I excavated Piklihal in 1951. Almost three to four excavation reports were available then; that of Brahmagiri in the 1930's; and I had also seen Wheelers's work; and Subbarao's report of a small excavation at Sanganakallu in his Ph.D. thesis. When I started work at Piklihal, I very soon realized that the large number of cattle bones probably pointed tocattle keepers. This fact never came out in the earlier works. Neolithic terracotta figurines of cattle suggested their importance in the economy. Although I feel that my conclusion in this report was a synthetic reconstruction of their lifeways and economy and amateurish, it did carry the subject further. One must appreciate Robert Bruce Foote who really started the interest in ashmounds. While talking to Mortimer Wheeler in1957, regarding the ashmound of Utnur, he said "I shouldn't worry with those things. Industrial sites". The reason for choosing to excavate Utnur, was the presence of a scatter of Early Historic pottery around it. This could prove or disprove this statement of Wheeler's.

S.P.: Would you comment on the present state of research on the south Indian Neolithic?

F.R. Allchin: Well, comparatively little work had been done since the excavations at Utnur and the results then were relatively inconclusive. I was delighted when Dr. Paddayya started to re-examine this problem and to look at sites we had visited and studied earlier. He was right when he contradicted us as regarding the scatter of occupation debris at Kudatini. He was not so right when he criticized us for failing to notice an area of occupation at Utnur. This we recorded although we did not see its significance then. At Budihal, there is extensive emphasis on the ashmound, with a settlement context and a cattle keeping lifestyle. This is an enormous contribution of Dr. Paddayya's. There are however, a number of problems in the archaeology of Andhra and Karnataka. I was very disappointed to find that little fundamental work has been done. There are very few who are willing to undertake a broad synthesis of the Southern Neolithic. Questions regarding its origins or its interface with the Mesolithic need to be answered. It is just not enough to survey and document sites. I had hoped to carry this work further. Sankalia's work at Kupgal is also notable in this regard.

S.P.: Your two books the Birth of Indian Civilization and the Rise of Civilization in India and Pakistan provide a panorama of the entire breadth of Indian archaeology. Can you comment on the aims between writing these books?

F.R.A.: With the exception of Piggot's book, the Birth of Indian Civilization is the only one of its kind and reflects our joint views. At that time, in writing it, we are very conscious that we were amateurs and were rather inexperienced. We were very anxious not to put in too many of our own ideas and include the ideas of others which we agreed with. Although the Birth of Indian Civilization is out of date, it stands out asa statement made in 1968 of what was then new. My wife, was rather embarrassed at having it republished. It was not my idea but Davidar put pressure to have it reprinted. We couldn't rewrite it, so we wrote out anew preface I don't' feel embarrassed, though there is always a problem of reprinting a book without mentioning the original date of publication. It does seem to be selling very well. As for the Rise of Civilization in India and Pakistan, both of us wanted it to be the last book of its type. We tried to make it as synthetic a view of the subject as we see it.

B.A.: The Birth of Indian Civilization, is more of a mini-textbook for students, containing a lot of useful summaries of the situation at that time. It cannot really be rewritten.

F.R.A.: So much important material has been left out.
S.P: What would be your message for young Indian Archaeologists?.

B.A. and F.R.A.: We have tried to express this in our lectures to the conference. In summary we must be prepared for changes of approach and changes in the types of jobs available. There has to be a move away from large excavations to problem oriented archaeology, exploring all kinds of new techniques and methods of analysis. There must also be much greater emphasis on conservation of the South Asian heritage, public education and cultural tourism. Co-operation with other disciplines is as essential in later prehistoric and historic archaeology as it is in earlier prehistory.

Report on the National Seminar on River Valley Cultures of India

A National Seminar on River Valley Cultures of India was organised by the Indira Gandhi Rashtriya Manav Sangrahalaya, (National Museum of Mankind), Bhopal from 21st to 24th September 1998. Over the last two years, IGRMS, Bhopal has been working on a number of projects throughout the country, one of them being the river valley cultures of India. The Narmada river valley system was taken up on a priority basis because of the construction of a number of dams on the river, which when completed would submerge some of the areas containing archaeological treasures. This fact necessitated salvaging and documenting archaeological, palaeontological, ethnological and other records in their original context before these treasures were lost forever. The idea of the recently held seminar at Bhopal was to review the progress made during the last two years or so and to bring various specialists from all over the country and interested in the riparian system in of India, onto a common platform to enable scholars to work out a research strategy that would be of significance for future development of the disciplines in which they are concerned both well as one that would benefit the common people plagued by the vagaries of nature, and especially the rivers.

The seminar was not restricted to documenting the various geological and archaeological discoveries and their interpretations but was also aimed at broader themes involving humans an in these river valleys, like environmental assessment, disaster management, policy matters, etc. Over 100 delegates from various universities, institutions and Government agencies (e.g. the Geological Survey of India, Archaeological Survey of India, Central Ground Water Board, State Departments of Archaeology and Museums), as well as NGOs like INTACH, the Narmada Bachao Andolan, Econet, Joint Assistance Centre, Lokodyam Sanstha etc.; were represented. A field trip was also organized to Sanchi, Vidisa, Udaigiri and the Betwa river.

Keeping the thematic aspects in view, the presentations were also arranged geographically. From the mountains to the seas, and from north to south, they highlighted the various implications of riparian systems showing the archaeological, anthropological, geological, and other aspects with a direct impact on the social problem of rehabilitation of the communities, which were or are, settled along the banks of the rivers. The fact that almost all the river valleys from north to south were included in the presentations and discussions brings out the fact that the IGRMS plans to take up, in future, each river valley in its total perspective.

Dr. K.K. Chakravarty's introductory address focussed on the global change in the larger concept of museum as a static store-house to museum as outdoor movement. He cited examples of activities in which museums have to play a positive role in educating humankind, and stressed that museum movement is in itself a learning process. G.L. Badam dealt with the various activities of IGRMS, its role in interacting with the common man and the various factors that led to the holding of the National Seminar. M.N. Buch, former Chief Secretary of Madhya Pradesh, who was the chief guest at the inaugural function, appreciated the work undertaken from by IGRMS and stressed the need to preserve the environment as far as possible. Environmental degradation, he emphasised, was partly due to anthropogenic factors and defective planning especially in the third world countries. He gave examples of pollution of Indian rivers to which man has contributed a great deal. Natural factors are beyond anybody's control but things could improve with better planning.

In the course of the deliberations Himalayan geology, ecology and related cultural history were discussed by seven scholars; the sub-Himalayan tract of West Bengal, and the archaeology of the Indo-Gangetic belt and Orissa by twelve scholars; Gujarat and Rajasthan archaeology by six scholars; Madhya Pradesh geology and cultural evolution by ten scholars; and Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu and other areas by about twenty scholars. In addition to these there were presentations of general interest including the ones by non-Government agencies.

Two very informative special lectures one by Dr. K.N. Prasad (former Director of the GSI) on the 'Biodiversity of the Past' and the other by Prof. S.N. Rajaguru (former Joint Director, Deccan College) on 'Quaternary Climatic changes and Stone Age Cultures of India: a

Geoarchaeological Approach' were arranged. After the academic deliberations, music and dance followed on all the days of the seminar. Professional artists from Tamil Nadu, Andhra Pradesh and Orissa presented cultural programmes relating to water festivals. A special exhibition displaying various aspects of the river valleys, with emphasis on the Narmada river, was inaugurated by the Chief Guest, His Excellency Dr. Bhai Mahavir, Governor of Madhya Pradesh on 23rd September.

One of the important aspects of the seminar was the demonstration of computer assimilation maps of the entire Narmada Valley (by a team from the Regional Remote Sensing Centre, Nagpur) showing the geological formations, archaeological sites, heritage points, location of dams, areas under the zone of submergence, etc., and the demonstration of the LAAR technique (Low Altitude Aerial Reconnaissance technique carried out by unmanned, remotely controlled Aeromodel) by a team of Deccan College, Pune Aerial photographs of part of the campus of the IGRMS and taken using this technique were distributed to the participants during the seminar. These two demonstrations showed how science and technology could be integrated to highlight the hitherto unknown aspects of our cultural history.

At the valedictory function on 23rd September the Chief Guest and Governor of M.P. Dr. Bhai Mahavir deplored the political interference in the running of various institutions which results in poor co-ordination and naturally poor output giving various examples. He said that the problem of the environment should be tackled on a war footing. Institutions should go to the masses to educate and help them as is reflected in the current activities of the IGRMS. Dr. B.K. Roy Burman, Chairman of the Academic Advisory Committee of IGRMS stressed various planning strategies that need an overhaul and appreciated the role of IGRMS in the new museum movement. Dr. Chakravarty summarised the museum activities in the context of the seminar and Dr. Badam read out the recommendations that emerged during the seminar.

The academic deliberations of the few days at IGRMS, and cultural programmes, exhibitions and field trips around Bhopal generated a great deal of interest in the academic surroundings as well as in our understanding of the diversity and dynamism of our riparian systems. This seminar concluded with the note that no planning is complete if it falls short of the demands of the people for whom the planning has been made. It helped build a bridge between science and society, usually where in our society a hiatus exists.

K.K. Chakravarty, Convenor,
Indira Gandhi Rashtriya Manav
Sangralaya, Bhopal

G.L. Badam,
Co-Convenor,
Deccan College,
Pune 411 006

INDIAN SOCIETY FOR PREHISTORIC AND QUATERNARY STUDIES

c/o Department of Archaeology, Deccan College, Pune 411 006

BALANCE SHEET AS ON 31st MARCH 1998

Funds & Libialities	**Rs.**	**Rs.**	**Property & Assets**	**Rs.**	**Rs.**
Trust Funds or corpus	558,543.40		Immovable Properties		
Bal. as per prev. B/S			Bal.as per prev.B/S	0.00	
Adjustment during the year			Add: During the year	0.00	
(Donations recd during the year)	0.00	558,543.40	Less: Sold during theyear	0.00	
			Less: Depreciation @ 5%	0.00	0.00
Other Earmarked Funds —	83,607.95				
(Created under the provisions of the					
trust deed or scheme or out of the income)			Investments (As per Schedule II)		837,888.96
Depreciation Fund			Other Movable Properties		
Sinking Fund			(As per Schedule III)		
Reserve Fund			Bal.as per prev.B/S.		134,314.23
		83,607.95	Add: During the year	0.00	
Loans (Secured/Unsecured)			Less: Sold during year	0.00	
			Less: Depreciation @ 5%		
(As per schedule)			Loans (Secured or Unsecured)		
For expenses			Loans Scholarships		
For Advance			Other Loans	0.00	
Dr P.K. THOMAS	212.73		Cash & Bank Balance		
MOHANTY	1,000.00	1,212.73	Cash	1,260.00	
For rent and other deposits			Bank balances	1,14,670.32	115,930.58
Audit fee Provision for	2,200.00		Income Outstanding		
contribut.	788.00		Rent, Interest, Other Income		
			Cash	0.00	
		2,988.94	Bank Balances (As per Schedule IV)	0.00	0.00
Income & Expenditure A/c.			Income & Expenditure A/c.		
Bal.as per prev.B/S.	394,404.37		Bal.as per prev.B/S	0.00	
Less: Appropriation if any			Add: Deficit for the year	0.00	0.00
Add: Surplus per Inc & Exp. A/c.	47,376.38	441,780.75			
Total Rs.		1,088,133.77	Total Rs.		1,088,133.77

As per our report of even date
FOR A.S.CHANDVANKER & CO.
CHARTERED ACCOUNTANTS

Date: 31-10-98
Place: PUNE

A.S. CHANDVANKER

(V.N. Misra)
GENERAL SECRETARY

(P.K. Thomas)
JOINT SECRETARY

(V.S. Shinde)
TREASURER

INDIAN SOCIETY FOR PREHISTORIC AND QUATERNARY STUDIES

c/o Department of Archaeology, Deccan College, Pune 411 006

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31st MARCH 1998

Expenditure	Rs.	Rs.	Income	Rs.	Rs.
To Expenditure in respect of Properties			By Rent *(accrued)/(realised)		0.00
Rent, Taxes, Cases					
Repairs & Maintenance			By Interest *(accrued)/(realised)		
Salaries			On securities		
Depreciation (By way of		29,677.03	On deposits	3,611.00	
prov. or adjustment			On loans		
Other Expenses			On Bank Account	0.00	3,611.00
To Establishment Expenses		77,977.50	By Dividende		
To Remuneration to Trustees			By Donations in cash or kind		
To Remuneration (in the case of math) to the head of the math including his houshold exp			By Grants	72,500.00	
			By Income from other sources in details as far as possible		
To Legal Fees			ICHR GRANT RCD (CONFERENCE)	11,400.00	
To Interest Paid			LIFE MEMBERSHEEP FEES	18,100.00	
To Audit Fees		2,000.00	M & E VOLUME SALE	75,999.00	
			SALE OF DHP	2,205.00	107,704.00
To Contribution and Fees					
To Amount Written Off					
To Miscellaneour Exenses					
To Depreciation					
To Amount Transferred to Reserve or specific fund			By Transfer from Reserve		
To Expenditure on object of the Trust (As per Schedule 'A')		26,784.09			
To Surplus carried over to B/s		47,376.38	By Deficit carried over to B/s		
Total Rs.		183,815.00	Total Rs.		183,815.00

As per our report of even date
FOR A.S.CHANDVANKER & CO.
CHARTERED ACCOUNTANTS

Date: 31-10-98
Place: PUNE

A.S. CHANDVANKER

(V.N. Misra)
GENERAL SECRETARY

(P.K. Thomas)
JOINT SECRETARY

(V.S. Shinde)
TREASURER

ISSN 0258-04

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